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No. 3081

United States Circuit Court of Appeals ¹ 1131

For the Ninth Circuit

MINERALS SEPARATION, LTD.,
ET AL,

Appellees,

vs.

BUTTE & SUPERIOR MINING
COMPANY,

Appellant.

Transcript of Record

Volume 9---EXHIBITS

(Pages 4889 to 5565, Inclusive)

UPON APPEAL FROM THE UNITED STATES
DISTRICT COURT FOR THE DISTRICT
OF MONTANA

FILED

JUN 24 1918

F. J. MONTGOMERY



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UTAH COPPER COMPANY, MAGNA PLANT.

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Exhibit No.		Offered in Evidence Page	Printed Page
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Plaintiff's Exhibit 1.

THIS AGREEMENT, made and entered into this 22nd day of July, 1911, by and between the Butte & Superior Copper Company, Limited, a corporation created and operating under and by virtue of the laws of Arizona, and doing business in Montana, party of the first part, and J. M. Hyde, party of the second part;

WITNESSETH: WHEREAS, James M. Hyde claims that he has knowledge of a method of treating certain ores of the character of the ore produced in the BLACK ROCK MINE, the property of the Butte & Superior Copper Company, Limited, by means of a process known as "The Gas Bubble Flotation Process," and whereas the said Hyde represents that in his best judgment an increased saving in the milling of said ores being treated by the Butte & Superior Copper Company, Limited, at the mill operated by the said Butte and Superior Copper Company, Limited, at Basin, may be made by the use of said process, and, WHEREAS, The Butte and Superior Copper Company, Limited, is desirous of testing the efficiency of the said process with a view of ascertaining whether or not the use of the said process will increase the saving of values at its said mill;

NOW THEREFORE, for and in consideration of the mutual promises and agreements of the parties hereto and the covenants, and agreements hereinafter contained, the parties hereto do hereby agree as follows, to-wit:

Plaintiff's Exhibit 1.

The said Company agrees that it will furnish a sum not to exceed Twenty-Five Hundred (\$2500.00) Dollars to be used by the said Hyde in the equipment and installation of a fifty (50) ton experimental plant for the use of the said flotation process at Basin, Montana, the said plant to be erected under the supervision of the said Hyde, he to have full charge of the erection of said experimental plant provided, however, that in the construction and operation of the said experimental plant the running of the mill now operated by the Butte and Superior Copper Company, Limited, shall in no-wise be interfered with.

The said Company further agrees that the said Hyde may engage his own assistants for the operation of the said experimental plant provided that the payroll of the men employed by the said Hyde in the operation of the said experimental plant shall not exceed Forty (\$40.00) Dollars per day, and the said Company agrees that it will pay the said payroll provided the sum does not exceed Forty (\$40.00) Dollars per day. It is expressly agreed and understood that the said Hyde shall receive no sum whatsoever as compensation either for the construction or operation of the said experimental plant save and except his personal expenses while engaged in mill work in the said Company's behalf, said sum not to exceed Five (\$5.00) Dollars per day.

It is further agreed and understood by the said Hyde that said experimental plant shall be operated

Plaintiff's Exhibit 1.

for a period of thirty (30) days after its completion, the said process above referred to to be used exclusively in the operation of said experimental plant and that if in the judgment of the General Manager or Superintendent of the Butte and Superior Copper Company, Limited, the plant has not shown that the process used can increase the profits of said Company by at least twenty-five (25c) per ton on each ton of ore treated, the Company may at its option declare this agreement null and void and of no force or effect and neither party hereto shall have any further right or claim under this agreement.

It is further agreed that if in the judgment of said Hyde at the expiration of said thirty (30) days test work in the experimental plant, it does not appear that the process can be used by the Company to enough profit to insure him a sufficient compensation to warrant him in giving further time to the business, he may declare this agreement null and void and of no effect after he has instructed an agent of the Company thoroughly in the details of the process and has released the Company from all further financial obligation to him other than the payment of his expense account as herein provided.

It is further agreed and understood that if the treatment of ore in the said experimental plant has not indicated that the process can be operated to the financial benefit of the said Company the said Company shall so declare to the said Hyde and this agreement shall be null and void and neither party hereto will have any right or claim hereunder.

Plaintiff's Exhibit 1.

It is further agreed, however, that if in the judgment of the General Manager or Superintendent of the said Company, the said process is adaptable to the profitable treatment of the ore mined at the Butte and Superior Copper Company, Limited, mines at Butte, Montana, and that by use thereof a sufficient financial saving can be made by the said Company to justify the adoption of the use of the said process, the Company will immediately furnish funds for the purpose of installing a plant sufficient in size to treat all of the ore not recovered as jig concentrates in the present plant operated by the said Company at Basin, Montana, when the mill is treating 400 dry tons per day, provided, however, that the total cost of said last mentioned plant shall not exceed ten thousand (\$10,000.00) Dollars.

The said Hyde agrees to furnish plans for the erection and construction of said last mentioned plant and further agrees to personally supervise the erection and construction of the said plant, and the said Hyde further agrees that he will make no charge whatsoever for his services in this connection save and except as hereinafter provided for and the said Hyde further agrees that after the completion of said last mentioned plant, he will supervise its operation in the use of the "Gas Bubble Flotation" process for a period of at least ninety (90) days and that during said period he will fully instruct an agent of the said Company in the operation of the said plant so thoroughly that the said agent of the said Company will be able to operate

Plaintiff's Exhibit 1.

the said plant without the assistance of the said Hyde, provided, however, that the said Hyde shall not be obliged to devote more of his time to the personal supervision of the plant than in the judgment of the General Manager or Superintendent of the said Company is necessary to its successful operation or for the complete instruction of the said Company's agent. It is agreed and understood that during the erection of the last mentioned plant and during the operation of same the employees of the said Company may have full and complete access thereto, but that during the erection and the operation of the experimental plant the said Hyde shall have the right to exclude any and all persons from the building in which the said experimental plant is being constructed or operated.

It is agreed and understood that the said Hyde shall receive as full remuneration and compensation for all services rendered (excepting personal expense account as herein provided) a sum equal to one and two-thirds of every dollar of increased profit which shall accrue to the said Company through the operation of the said larger plant during any continuous period of thirty days which the said Hyde may select within the first ninety days that the said plant is operating after its final completion and during which the grade of ore treated has not averaged over twenty-one (21%) per cent. zinc nor less than eighteen and one-half (18½%) per cent. zinc and the tonnage treated has been at least twelve thousand (12,000) dry tons during said period of thirty (30) days, it being under-

Plaintiff's Exhibit 1.

stood and agreed that the said Hyde shall receive no further remuneration or compensation from the said Company save and except the said compensation to be paid ~~this~~ ^{said} Hyde on the increased profits which have accrued to the Company during the said period of thirty (30) days so selected by the said Hyde.

It is especially agreed and understood that the basis of the increased profits of the said Company in the operation of the said entire plant, upon which increased compensation of the said Hyde shall be based, shall be determined by comparing the profits of the operation of the entire completed plant, including the said flotation plant, with the operation of the said concentrating plant, in the following manner, to-wit:

1. The net smelter returns for the product made during the thirty days so selected by the said Hyde during which time his compensation shall be estimated, shall be calculated on the basis of \$5.20 per hundred weight, as the market price of spelter, f. o. b. cars St. Louis, Mo.

2. The milling cost of the concentrating plant as operated before the installation of the flotation equipment shall be assumed to be one dollar and fifty-one (\$1.51) cents per dry ton of ore treated.

3. The recovery of the concentrator plant as operated before the installation of the flotation equipment shall be assumed to be seventy (70%) per cent. with the proportion and grades of concentrates, as follows, to-wit:

82% of zinc recovered as concentrate containing 50.8% zinc, no penalty.

Plaintiff's Exhibit 1.

5% of zinc recovered as concentrate containing 50.4% zinc, 50 cent screen penalty only.

13% of zinc recovered as concentrate containing 45.0% zinc, 50 cent screen penalty only.

4. In arriving at what shall constitute a dry ton of ore it is agreed that 2.6% of the railway weight shall be deducted from the ore treated during the said thirty days period.

5. From the sum of the calculated net smelter returns of the concentrating plant after the flotation process has been installed shall be subtracted the total cost of milling all ores in the Basin plant including the flotation plant, the result thereof being a sum herein designated as "Total Results".

6. From the calculated net smelter returns on the same amount and equal grade of ore as treated during the said 30 days on the basis of a seventy per cent. recovery with values as stated in paragraph No. 3, shall be subtracted the total calculated cost of milling in the concentrating plant at Basin, exclusive of the flotation plant installed by the said Hyde, at the rate of \$1.51 per ton of dry ore treated, the result thereof being a sum herein designated as "Present Results."

7. The said Hyde shall receive as full compensation for his services hereunder a sum equal to one and two-thirds of the amount represented by subtracting the sum herein referred to as "Present Results" from the sum herein referred to as "Total Results", that is to say, if the sum represented as "Total Results" should be \$100.00 and the sum represented as "Present Re-

Plaintiff's Exhibit 1.

sults" should be \$60.00, the said Hyde shall receive as his full compensation one and two thirds times \$40.00, equal in amount Sixty-six and two-thirds (\$66.2/3) Dollars.

It is especially agreed and understood by and between the parties hereto that in no event shall the said Hyde receive as compensation for his services a sum in excess of \$30,000.00

It is especially agreed and understood that the said Company will at the expiration of any thirty continuous days run of said mill and flotation plant during the said ninety days after the completion of the said flotation plant pay to the said Hyde as partial payment not to exceed fifty (50%) per cent. of the amount calculated by the Superintendent of the Butte and Superior Copper Company, Limited, to be due him on the increased earnings, if any, during the said thirty day period.

It is further agreed and understood that the remainder of the sum, if any, due to the said Hyde as compensation under this contract, shall be paid by the Butte and Superior Copper Company, Limited, upon receipt by the said Company of smelter returns on ores treated during the period, upon which the compensation of the said Hyde, if any, is based.

It is further agreed and understood that in all calculations provided for in this contract and in calculating the amount due said Hyde hereunder, all sums received or to be received by the Butte and Superior Copper Company, Limited, from the sale of lead concentrate shall be eliminated.

Plaintiff's Exhibit 2.

IN WITNESS WHEREOF, the parties hereto have hereunto set their names and seals this day and year first above written.

Butte and Superior Copper Company, Limited,
By A. B. Wolvin, Pres't.
James M. Hyde.

(Endorsed)

AGREEMENT

Between

Butte & Superior Copper Co.
Limited,
and
J. M. Hyde.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 2.

WHEREAS, James M. Hyde has undertaken certain work in connection with the milling operations of the Butte and Superior Copper Company, Limited; and,

WHEREAS, under the terms of a contract now existing sums of money to be paid the said Hyde are not yet due; and,

WHEREAS, the said Hyde is desirous of obtaining at this time, and in the near future, certain payments of money;

Plaintiff's Exhibit 2.

NOW WHEREFORE, the said contract existing is now modified with respect to the time of payment of moneys in the following manner, to-wit:

The said Butte and Superior Copper Company, Limited, has this day paid to the said Hyde the sum of \$5,000.00 to apply upon any future payments that might be found to be due, and does agree to pay the said Hyde \$5,000.00 on the 1st day of January, 1912, provided the milling operations at Basin, Montana, conducted by the said Butte and Superior Copper Company, Limited, show an increase earning by virtue of the use of the flotation plant therein installed in excess of \$5,000.00 for the month of December, 1911.

The said Butte and Superior Copper Company, Limited, agrees to pay the said Hyde \$5,000.00 on the 1st day of March, 1912, provided the milling operations at Basin, Montana, conducted by the said Butte and Superior Copper Company, Limited, show an increase earning by virtue of the use of the flotation plant therein installed in excess of \$5,000.00 for the month of February, 1912.

It being the intent of this agreement, that if the flotation plant installed by the said Hyde at Basin, Montana, should cause an increase in the months of December and February to the extent of \$5,000.00 for each month, the said Company will make the payments aforesaid to the said Hyde; the total payments, however, including the \$5,000.00 paid this day, shall not exceed \$15,000.00 until such time as the new concentrator of the Butte and Superior Copper Company,

Plaintiff's Exhibit 2.

Limited, is in operation at Butte, Montana, when a thirty day run of the selection of the said Hyde may be made in the same manner and within the same time as provided in the original contract between the said Hyde and the said Company, and the Company shall thereafter pay the said Hyde the sum in excess of \$15,000.00 if any, found to be due him, not to exceed, however, the additional sum of \$15,000.00. If no sum in excess of \$15,000.00 is found to be due the said Hyde under the terms of said contract, then the said Hyde shall be considered to have been fully paid and compensated under the terms of said contract.

It is understood and agreed between the parties hereto that the terms of said contract with reference to the amount to be expended in the construction of the larger plant referred to in the contract heretofore existing between the parties hereto shall be considered by both parties to have been fully satisfied without additional expenditure on behalf of the Butte and Superior Copper Company, Limited, at the Basin Concentrator.

The right is reserved to the said Hyde to select any thirty consecutive days' run of the Basin Concentrator during the continued operation thereof by the said Company as the basis upon which his compensation shall be fixed under the said contract, and to demand that settlement be made thereon in accordance with the original contract between the parties thereto crediting, however, all sums theretofore paid him by the said Company as payments upon the amount found to be due him.

Plaintiff's Exhibit 3.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands and seals this 26 day of October, 1911.

James M. Hyde,
Butte and Superior Copper Company, Limited,
By A. B. Wolvin, Pres't.

* Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 3.

September 21st, 1911.

J. M. Hyde, Esq.,
Basin, Montana.

Dear Sir:

With reference to the contract which J. Bruce Kremer drew up last June in accordance with terms which were agreeable to yourself and myself and which I submitted to the directors of the Butte & Superior Copper Company, Limited, for approval:

I received on July 6th, from A. B. Wolvin, president of the company, a telegram instructing me to proceed with you in accordance with the contract.

You installed and operated an experimental plant and convinced me of the economic value of your process as applied to Butte & Superior ore, and I have recommended to the directors that the larger plant referred to in the body of the contract be installed at

Plaintiff's Exhibit 3.

Basin, at once, but with certain modifications, which seemed under the circumstances governing conditions at Basin to be advisable. I shall not enumerate the conditions in this letter, as they are well known to both of us, but the literal carrying out of the agreements made in the contract with the above mentioned modifications will not be fair to you, and I wish to present to you the following proposition

You will remain in Basin until the construction of your larger plant is completed and operating, and until the man appointed by Mr. Collins to do the work shall have become thoroughly conversant with the handling of the larger unit. As long as you remain in Basin you are to receive the same amount of money to cover living expenses as was provided in the contract.

After you and I have mutually agreed *that the* larger plant is operating as successfully as can be expected, you will be at liberty to depart. I have in mind as the date of your departure some time between the 10th and 20th of October, but it may be sooner.

After you leave Basin, you are to continue your investigations concerning the best plans to follow in the erection of the gas bubble flotation unit, which is to be part of the new zinc mill which we are to build at Butte and advise me from time to time of your wishes in the matter, so that the plant may be built to suit you, as far as is consistent with the approximate expenditure of \$10,000.00 for apparatus and construction expenses. The building proper is not included in this limit of expense.

Plaintiff's Exhibit 3.

During your absence from Basin or Butte, I shall keep you fully posted on the progress and details of the construction of the new mill, so that you can arrange to be in Butte to supervise the completion of your part of the plant and to start its operation. As soon as the plant in the new mill is running smoothly, we shall consider your 90 day test, as provided in the contract, as on.

In consideration of the extended period you will be obliged to devote to our business, you shall have the right to demand an initial payment, under the terms of the contract, of up to \$7500.00 before the end of the ⁶⁶calendar year. Or if you desire to remain in Basin for 90 days after your larger unit is running, and accept the results thereof as final, this is to be your privilege, and final settlement will be made under the terms of the contract.

In case of any accident to yourself during your proposed absence from Butte & Superior, which might prevent your return, the Company will consider the terms of the contract binding and pay to you or to anyone you may legally designate such sums as may be due you under the terms of this contract.

If you desire to accept the proposition, as outlined herein, please notify me to that effect and I will forward the proposal to Duluth for confirmation.

Yours very truly,

MWA/G

M. W. ATWATER.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 4.

1041 Shattick Ave.,
Berkeley, Cal.
April 24, 1913.

J. L. Bruce, Esq.,
Butte, Mont.

Dear Sir:—

I did not have an opportunity to see you and discuss the company's agreements with me before leaving Butte. As the original agreement does not fit conditions as they have been changed since it was entered into, it will be necessary for me to take the matter up anew with your officers. Mr. MacKelvie has suggested that we get together and dispose of the matter when he is in the west, and I am making arrangements to meet him when he is in Butte early in May.

I enclose herewith my expense account for the recent trip to Butte. The company agreed to pay my actual expenses when my time was given to the suit or to the milling operations. You will see by reference to your accounts that this has been regularly done in the past.

Hoping that all is going as well as can be desired at the mill I remain

Respectfully yours

James M. Hyde.

JLB

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 5.

BUTTE AND SUPERIOR COPPER COMPANY
Limited
25 Broad Street
New York, July 2, 1913.

J. L. Bruce, Manager,

Butte & Superior Copper Co. Ltd.,
O'Rourke Estate Building,
Butte, Montana.

Dear Sir.

Under date of June 14th I wrote you in reference to your getting up some data in connection with the Hyde process to use as a basis of settlement with him as provided for in his contract with the company for the installation of the Hyde flotation process.

Mr. Bocking took this matter up in his letter of June 27th. Mr. Bocking forwarded me several statements showing the comparative value of the mill zinc flotation concentrates, also statement showing comparative milling costs.

The direct charges against the flotation department for the month of May he gives as \$1.1881. In report form 19B, giving the distribution of cost of mill operation for repairs and maintenance, I find that the total cost against the flotation department is .873865c, so there is a discrepancy there of approximately 31c per ton.

Plaintiff's Exhibit 5.

Mr. Babbitt and myself have had a talk with Mr. Hyde this morning and we feel that the settlement of balance due on Mr. Hyde's contract should be based on report of the operating officials. The maximum amount to be paid to Mr. Hyde under any circumstances is \$30,000, and of this amount he has already received \$10,300.

In taking this matter up with Mr. Jackling some weeks ago, he stated that he was at a loss to suggest a method of determining what is due Hyde, if, in fact, anything is due him.

I have had in my mind the outcome of the suit of the Minerals Separation Company against Hyde, but the contract with Hyde was entered into with practically full knowledge of this pending litigation, and later the company made an agreement with Hyde to defend this suit for him and at that time did not ask for any modification of the then existing contract. I have not the contract before me but it is my understanding that Hyde had the right to take the results of any 30-day period within three months after the construction work had been completed, and it is Hyde's claim that this construction period was not ended until April of this year and that on the results for the month of May he is entitled to \$19,700 as the balance due him.

There is no possible way with the data before us that we can answer any of the contentions that Hyde makes, particularly in being denied the privilege by

Plaintiff's Exhibit 5.

the former management of making suggestions in regard to the operation or application of his process.

In Mr. Jackling's absence and in view of the fact that Hyde has to return west today, I have suggested his taking the matter up with you and Mr. Kremer in Butte, and as a result of your conference with him you can recommend to Mr. Jackling and myself the proper basis on which to deal with the settlement of this matter. Mr. Kremer must, of course, be very familiar with the previous arrangements and understanding as to the application of the present contract to the new mill at Butte, although the contract was based on operations of the mill at Basin.

If at all necessary I would be very glad indeed to meet Mr. Hyde in Butte or Salt Lake after Mr. Jackling's return and finally dispose of this matter, but you can familiarize yourself with the contract and if in your discussion with Hyde there are any points you feel should be passed on by Mr. Babbitt from a legal point of view, you might wire me.

Yours very truly,

N. B. MacKelvie,
President.

Copy to Mr. D. C. Jackling.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 6.

En route to Washington

Jan. 5, 1911 ?

1912

M. W. Atwater,
Butte, Montana.

My dear Max:

Ever since I left you I have been studying over the matters which we discussed yesterday.

Re Rope Drive. It will be very easy for us to determine the exact amount of power necessary to drive a 24" diam., 3" high agitator at 300 R.P.M., and at the same time make an important experiment concerning the possibility of increasing the capacity of your Basin flotation plant at almost no cost. As the mixing boxes are 26" in the clear they will take this size agitators, and after the test, if it is seen that they are too large for those boxes, they will be available for the new mill.

I consider this test as very important and want to withdraw my final approval of your rope drive, and ask you to hold up the order until this test is made, by one of you with or without me. As I was yesterday informed, for the first time, that the Basin machine cannot handle the tonnage for which it was planned, it seems possible that in the new mill a larger machine than has been anticipated and one that will possibly require more than 2½ H.P. per spindle may be needed.

Will you please have the Iron Works get out a set

Plaintiff's Exhibit 6.

of propellers for the side of the machine which is shut down. Make them 24" diam. 3" high and have them bored to place on the spindles so that when they are driven as the spindles on that machine are the strengthening webs will be on the back. Rush them through if you can and have the machine already to run when I arrive if you can possibly do so.

I will have to spend a few days on personal business in Washington and New York but will rush it through and get back to Butte as soon as possible and put in enough time there and at Basin to collect the necessary data and complete the plans for the flotation department of the new mill.

As the directors asked me, after the meeting in your office at which the subsidiary contract was agreed upon, to supervise all of the planning of the flotation department they will naturally hold me responsible as to the success of the same unless my plans are ignored and overridden. I am heartily in favor of a rope drive, but we must be very certain that it will give all of the power necessary to drive the size of machine which we will have to use, and I am not yet convinced that 2½ HP per spindle will be enough.

Re Pulp Thickening. All of my experience in drawing thickened pulp from plugs, even under constant pressure, indicates that it is extremely difficult to get a flow of constant volume and thickness by that means. The more I think of the device you have planned for this work the more certain I am that it will be a source of not occasional, but constant trouble to you. There is no more important problem to be met in the new mill

Plaintiff's Exhibit 6.

than that of giving the flotation machine a feed of absolutely constant volume and thickness. It is so important as to warrant installing two complete sets of different devices in order to be certain that the best results can and will be achieved. I hope that you will save suitable space for installing two 16" tanks and their pumps (two units of the device we discussed yesterday) and that you will see the wisdom of having them installed when the mill starts to run, so that there may be no hitch in its work.

My understanding has been that there were to be ample funds available to build the best mill that can be planned. If that is the case it will be very unwise to run any chance of not starting off right, in order to let the mill make money available for further equipment as you suggested yesterday. That policy is an extremely wasteful one as Basin has proven.

I will write a letter to Capt. Wolvin at once making my recommendations with regard to this matter, as we decided yesterday. I believe he will feel that any moderate expense which is necessary to insure the best work is warrantable.

I trust that I shall be back in about two weeks.

With best regards to you all I remain

Sincerely yours,

James M. Hyde.

P. S. Please have this typed & keep a copy for me.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 7.

COPY

20 B

May 17, 1913.

Mr. D. C. Jackling,
Vice Pres. & General Mgr.,
Utah Copper Co.,
Salt Lake City, Utah:

Dear Sir:

I enclose herewith bill for professional services rendered by Sheridan, Wilkinson, Scott and Richmond as referred to me by Mr. Kremer, together with correspondence regarding same. This bill seems very high and Mr. Kremer thinks in view of the fact that such considerable revenue has been derived by them for professional services in connection with the case prior to arguments of the same, that their charges for the argument are unreasonably high and that the same should be \$2,000 to \$2,350 less than the amount billed.

Will you kindly consider this matter, and in case you are not satisfied with approving the bill, correspond with Messrs. Sheridan and Scott until a satisfactory amount is rendered by them.

Yours very truly,

J L B
Manager.

JLB/FT

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 8.

20

B

Nevada City, Calif.

July 15, 1913.

Mr. N. B. MacKelvie,
25 Broad Street,
New York, New York.

My dear Mr. MacKelvie:

The result of our conferences at Butte was that Mr. Bruce and Mr. Kremer came to the conclusion that it would be better if the company's officers and I could agree on a lump sum settlement and not be forced to go into a close analysis of figures and a detailed interpretation of my contract. They were led to this conclusion by the discovery that our conceptions of the way in which the contract should be interpreted were so much at variance, that as they expressed it, we could never settle on that basis without submitting the matter to an unbiased and disinterested third party as a judge or arbitrator.

Of course, such a course as that would lead to delay, expense and controversy, all of which we are all most anxious to avoid.

The admission that a substantial payment should be made seems to be inconsistent with their contention that their interpretation of the contract is defensible, as by their interpretation of the contract they are able

Plaintiff's Exhibit 8.

to figure that nothing is due me. The plea that I should be willing to accept much less than I consider is due me, because the defense of my interests would be costly in time and money is perhaps a forcible argument to one in my circumstances in dealing with a powerful company, but it is not a convincing logical proof that I am not entitled to what was originally held out to me as an inducement to undertake this work, with all of the risks involved in it on the conditions under which I took it up.

As your own attitude has been so fair in this matter and Mr. Bruce and Mr. Kremer are convinced that a substantial payment should be made me, it ought to be possible for us to come to a just and friendly conclusion of the matter. My own desire is that the termination of our work together may be marked by a recognition upon your company's part of the great service I have rendered in solving your difficult ore treatment problems, accompanied with such a cash settlement that I can feel that I have been dealt with in a thoroughly fair and broad-minded spirit.

I wrote to you some time since that I should leave the matter of the interpretation of the contract entirely to your board of directors. I should not be prompted to any further explanation of the case if it were not for the great injustice and professional injury done me by the suggestion that my recommendations have lead to the installation of an unsuccessful plant which caused your company great losses, and that success was only attained after my plans were

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greatly changed by other engineers. I feel that that suggestion was prompted by a lack of knowledge of the facts of the case.

Knowing human nature as I do, I have foreseen that such a contention might possibly be raised, and I have carefully preserved my records, data, and correspondence, and have accumulated a mass of evidence which, I am absolutely confident would, in case of necessity, convince any unbiased umpire, board of arbitration, judge or jury that my plans were never substantially adopted until the month of April 1913, and that instead of my plans having caused the company great losses, the fact is that the refusal to adopt and work in accordance with my plans has cost the company an unnecessary loss of over half a million dollars.

It was not until April 1913, that the ore was ground approximately and continuously to such a degree of fineness that good recovery and a good grade of concentrates could be made simultaneously, and the pulp thickening plant was only then so amplified that it was no longer the practice to throw away a considerable portion of the finest and richest part of the ore untreated.

The tacit refusal of the old management to adopt and use my plans as called for by the contract has caused me great professional and financial damage, has denied me the advantage of a prompt demonstration of the striking value of the process I have perfected and has denied me the use of my money which would have long since been due and paid, and would

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have been of great value to me during the period of financial depression through which we are passing. While these are matters which were not under your individual control, they are acts of your company which you should give due consideration in coming to a fair settlement with me.

In order to take a fair view of this matter, it is essential to understand the conditions under which my relationships with the company were entered into, and the steps through which they have progressed. The misunderstandings which have arisen and the fact that some of those who are to pass upon this matter have no personal knowledge of the history of the transaction warrants a brief statement of the case.

In March or April 1911 I arrived in New York from London with H. C. Hoover. From Chester Beatty, Hoover learned that an examination of the Butte & Superior Mine was to be made by Kuehn to determine if Hayden, Stone & Co., would be warranted in taking up a bond issue on the property. I was introduced to Beatty and it was arranged that I should go along and assist Kuehn in the examination, and that when through with it I should make an independent study of the treatment of the ore at my own expense and report my findings to Hoover, who I was informed, with Beatty, was to have the privilege of participating in the bond issue, and who had agreed to carry me for an interest with them if my work showed that they were warranted in going into the venture.

After completing the regular examination, I com-

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menced a study of the ore with a test machine I had had the local iron works build for me. I got R. M. Atwater's permission to do so and he was very desirous that I should report my results to him. I refused to do so as I was making the tests at my own expense and had no occasion to report to anyone save Hoover, who I understood had some negotiations on in which he would take care of me.

Nutter, representing Minerals Separation, was present in Butte at this time, negotiating with the company, and shortly afterward went with the president and manager to New York.

Just after his return to New York, I received a request from Kuehn for some report of the results of my tests as they were needed by his principals in determining whether or not to take up the venture. After consulting my associates by wire, I furnished him with a statement that the results were satisfactory and showed that greatly increased profits were possible. I understood from him later that my report was a factor in determining his principals to take up the bond issue.

Shortly after this, I received a request from R. M. Atwater to make a study of their problem and report to them what could be done and how it could be accomplished.

At about this time I was informed by M. W. Atwater that the company had found it absolutely impossible to come to terms with Minerals Separation and that they would like to have me investigate the problem of

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their ore and tell them what I could do. As he was very urgent in the matter I cabled Hoover to learn how his proposition was developing, and received word from him that he was out of the venture, and to proceed independently if I saw fit to do so. I refused the meager compensation offered me by your company for a study of the problem, but told Atwater that I would make a sporting proposition out of it and would make a comprehensive study of the problem and report to them, charging them only actual costs for the investigation, on condition that they would make me a proposition after receiving my report, which proposition I would either accept or reject and give no further time to the matter.

Upon receipt of my report they made me the proposition which is embodied in my contract with the company dated July 22, 1911.

The essence of this contract was that I should carry out a test with a fifty-ton machine, receiving merely expenses for doing so, at the conclusion of which test, the company would, if the results obtained had warranted it, build a plant according to my plans and under my direction, which I should personally superintend the running of for ninety days time, and that I should receive as my compensation one and two-thirds time the increased profits made, over certain assumed previous results, in a thirty day period as a result of the use of the process introduced by me.

As first proposed, ten thousand dollars was suggested as the maximum fee to be permitted. I in-

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formed the company that as I was taking this as a sporting proposition that limit did not seem fair to me, and they raised it to thirty thousand dollars to induce me to take the matter up.

The 50-ton test machine erected and run under my directions for thirteen consecutive days gave a recovery of 91% and a product averaging 51.4% zinc as shown by assays and actual shipments.

It was decided to build a larger machine, and that part of my plans relating to the machine itself was carried out. This machine gave for the month of November, 1912, by the figures furnished me, 89.9% recovery in the form of a 48.2% product. The lower grade product was due to treating coarse material. My plans referred to in the contract were to cover the subject of pulp collecting and thickening, fine grinding of jig and table tailings, and the flotation treatment of all the ore, not recovered as jig or table concentrates. The company decided that they did not want to introduce the fine grinding and pulp thickening portion of my plans at Basin and a subsidiary contract was entered into postponing a final settlement until the completion of a mill in Butte. It was my understanding with the directors that my judgment and plans were to be followed in the new mill in those matters which were covered by the agreement with regard to the Basin mill.

For the new mill I planned the use of two four spitzkasten machines with 36' cells, gear driven, and equipped with both air lifts and special pumps. to be

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accompanied with the use of the two three spitzkasten 28" cell, gear driven machines from the Basin plant. That installation would ~~not~~ have had more capacity than the one now installed at Butte, and was practically of the type to which the Butte equipment was changed in April. The two machines at Basin were abandoned and left there, although they were in first class condition. The gear drives advised by me were abandoned for belt drives, which caused endless trouble and were replaced with gear drives early this spring.

My recommendation was that in addition to other pulp thickening device, there should be installed, as a safety measure, special automatic mechanical filters, which were not adopted, with the result that enormous losses of easily recoverable high grade mineral have taken place, and that the cost of treatment in the flotation department is still higher than it would be if these filters were being used to allow the re-use of the hot, acid, oil bearing water which could easily be recovered from the flotation tailings.

In my original report, in subsequent reports, in a series of brief notes prepared last fall for your engineers, and in tests and microscopic examinations made this spring, I have pointed out the absolute necessity of fine grinding if the best commercial results are to be obtained. Yet it was only in April 1913 that the fineness of crushing necessary to the obtaining of the maximum profits was adopted as a consistent policy.

Reference to my letter to you, of June 6th, 1912,

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written in response to your request that I should inform you of the outlook at the mill, will show that when the mill was first started I was foretelling the difficulties which have been experienced, and protesting, as I had done during the erection of the plant, against the management's refusal to adopt my recommendations as called for by contract.

For the refreshing of your memory and for the information of others of your directors whom I assume will see this letter, I will here again record the results which have at times followed the partial adoption of my suggestions as to how the plant should be operated. These records are suggestive of what phenomenal results would have been at any time achieved had my recommendations been carried out in full under my own personal supervision.

When I visited Butte in early December, as I returned from attending the taking of testimony in the patent suit, I found that the results which were being obtained in the mill were extremely unsatisfactory because the pulp was not being ground fine enough to treat, the slime thickening devices were inadequate for the tonnage being treated, and the use of chemicals in pulp thickening was done in such a way as to unfit the pulp for subsequent flotation treatment.

I went over all of the factors necessary for success with Frank Janney, Jr. and readjustments of manipulation were adopted and a lesser tonnage treated, giving tailings as follows:

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(I have no data at hand as to grade of concentrate, etc.)

Dec. 8, 1912,	Flotation tails	3.5, 3.1, 3.3,	Mill tails	5.1, 5.3, 5.2
Dec. 9, 1912	" "	2.4, 4.9, 2.6,	" "	3.4, 5.2, 4.3
Dec. 10, 1912	" "	2.7, 4.3, 5.6,	" "	3.6, 6.4 9.1

A study of all the mill feeds and products indicated that a recovery of 80% or better was being obtained, and certain alterations to bring the plant more into accord with my plans were agreed upon. As it would take some time to install these, I went to California.

The next I knew of results, I received word from you that the plant was making a very poor recovery, and went to Butte at once and found the following types of tails being produced:

Jan. 8, 1912,	Flotation tails	5.6, 7.0, 12.2	Mill tails	9.3, 13.2, 12.1
Jan. 19, 1913	" "	7.8, 7.4, 4.4	" "	11.6, 12.7, 8.2
Jan. 20, 1913	" "	6.0, 9.7, 6.0	" "	11.0, 12.4 7.8

A study of the operations of January 23, 1913, showed the following facts:

Ore Milled 785 tons @ 21.4% zinc

Mill concentrates 110 " @ 42.9% zinc

Flotation concentrates 120 tons @ 46.1, 46.8, 49.4

Flotation tails 470 tons @ 6.2

General mill tails 555 tons @ 8.9

Overflow slimes thrown away untreated: 85 tons @ 23% zinc.

These figures show that as the operations were

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carried on, with exactly the same equipment which gave the results shown above for January 8th, 9th and 10th, a large proportion of the zinc was thrown away as overflow slime, and that the material going to the flotation department was too coarse to give either a good recovery or a good grade of concentrate. The principal difficulty was that a larger tonnage was being milled than the mill could treat profitably.

Mr. Frank Janney, Jr. joined me at the mill, and ordered that the tonnage be cut down until the tube mills of the second section, which were standing idle, could be hooked up to handle part of the products of the first section. By correcting the tonnage and other factors, the following results were obtained:

Jan. 29, 1912 Flotation tails 2.8, 3.0, 2.9. Mill tails 5.6, 5.8, 7.3 again indicating such a recovery as obtained when operations were modified at my suggestion in December.

Even better tailings than these were obtained later, but the concentrates still showed that the grinding was not fine enough to free the quartz from the blende sufficiently to give high grade concentrates.

My suggestion that the tailings from the cleaner should be reground, which was made as early as when the mill was being planned, was adopted in April 1913, since when the concentrates have been of a higher grade.

After I had gone over the many factors involved in the work and shown Mr. Frank Janney, Sr. what

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my original plans called for, he did me the justice of telling me that he could see that if I had been given an opportunity to do so, I would have made a great success of the work long since.

I wish at this time to acknowledge my indebtedness to him and Frank Janney, Jr. for the efficient way in which they have adopted my plans as fast as I have been able to convince them of their practicability and for the assistance which they have rendered in whipping things into good mechanical condition.

It should be perfectly apparent to any fair-minded person that in view of the facts of the case, it would be doing me a great personal and professional injustice to hold me responsible for the poor results which have followed from spurning my plans and going contrary to my repeated counsel and advice.

Even had my plans been followed in full, instead of in part, it would have been necessary to have had all the work of pulp thickening, fine grinding and flotation done under my exclusive supervision, for such a period as ninety days, as the contract plainly called for, in order to give me an opportunity to demonstrate the economies and profits of which the process is capable, and never since the first tests on the fifty ton machine have I been permitted to have charge of all of the ^{parts of the} work necessary to insure the best results.

It is now plain to all concerned that your ore is one which is especially difficult to treat successfully,

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et I have worked out a special process for it which gives at once a higher recovery and higher grade product than have even been made from a similar ore so far as I can learn, and which could not be obtained by any other known process.

Had you dealt with Minerals Separation, I am informed by Capt. Wolvin that they would have demanded a royalty of 25c per ton for the period covered by the life of their patents. That would have amounted to a royalty of \$90,000 per year on a thousand ton mill. Even if that rate had been cut in two, it would have been \$45,000 per year on a 1,000-ton basis, for about twelve years time. They had never used the exact process which I have invented and patented even in Australia where they have done most of their work, and that exact procedure is apparently necessary in order to get such results as I have achieved with your ore.

The fact that a patent suit would result from proceeding to use a flotation process was known to all concerned, and the three attorneys upon the old board of directors should have been able to anticipate what a suit would mean in the way of costs. Our relationships are in no ways modified by the fact that the suit was brought in my name. Its object is to enjoin your company from the use of the process or compel it to pay a royalty, and is brought against me solely for the performance of acts carried out for your company. Had it been brought in your company's name direct, it would have cost as much to defend it, and

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I would have given it as much of my time as I have. I am of course aware that it will be greatly to my advantage to win this suit, and I am glad to express my appreciation of the liberal attitude of your board toward this whole matter of litigation.

I did not enter into this business as an impecunious engineer anxious for an ordinary fee. I had given up a position that would have paid me \$10,000 per year in order to work for myself, and I have, during the pendency of this work and suit, refused to consider the managership of one of the largest Australian zinc companies at a salary of £3,000 per year and perquisites, in part, because it was necessary to devote my time to this case and your work.

I entered into this work as a sporting proposition, taking most unusual risks of all kinds, and considering that I was allying myself with people who were willing that, if I made money for them, I should make money with them.

The solution of the ore treatment problem which I worked out was a large factor in increasing the market value of the stock to such a point that the bondholders could, if they saw fit, make 400% on their money, and will undoubtedly assure them of future opportunity of the same sort. The maximum profit that I could possibly make out of the venture is insignificant in comparison with the contribution to the success of the business which my process has proven to be.

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I have told Mr. Kremer that, while I consider that the full maximum fee should come to me, which would entitle me to a further payment of \$19,700, I will accept \$15,000 to avoid any prolonged discussion and possible controversy. I really hope that your directors' sense of sportsmanship and fair play will make them recognize that that is a concession which should not be demanded, when they understand the case fully. The full amount is scant compensation for the service rendered, to say nothing of the trouble, worry and neglect of other business which have been involved in this suit to gain you the right to operate without paying regular tribute to a fraudulent monopoly.

Mr. Bruce will go ahead with the preparation of figures to submit to me if it becomes necessary to go closely into all details of cost and recovery, and I shall not go into an analysis of figures until I have their recommendations while waiting to hear from you.

At the time the contract was entered into, Mr. Atwater and I figured that the process should yield approximately 90% recovery and a 50% zinc concentrate; that the extra costs of treatment should be 55c to 65c per ton, and that, on that basis, I would be entitled to \$30,000 in full when but 12,000 tons per month were being treated.

The only figures so far submitted to me show that approximately 90% recovery and 50% product have been achieved. The detailed figures which Wicks showed me for one of the early spring months showed

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flotation department costs of about 60c per ton. (I do not know how the high costs figured for May were derived.) Apparently our early forecast has been practically achieved, and on that basis by the terms of the agreement, I have assumed that the maximum fee should be due me, even if you had treated but 12,000 tons in May instead of 22,000 tons as you did.

If a settlement can be made as Kremer and Bruce suggest, on the merits of the case, it should not be necessary to await the preparation of more figures, and I shall be greatly pleased to be spared the necessity of making another long, expensive and tedious trip to attend to the matter, if it can be attended to promptly by correspondence.

However, if you consider it desirable for me to meet you and others in Salt Lake or Butte, I am willing to do so, if other plans permit, at such time as you may suggest.

I shall be glad to hear what you wish to propose in the matter.

Realizing that you agree with me in hoping that the whole affair may be disposed of within a short time, I remain

Respectfully yours,

(Signed) James M. Hyde

My address will be 1041 Shattuck Avenue, Berkeley, California as before.

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HAYDEN, STONE & CO.

20

BANKERS

B

New York-Boston

New York, July 28, 1913.

Mr. J. L. Bruce,
Butte,
Montana.

Dear Sir:

For your information I am enclosing copy of a letter I received from James M. Hyde, which was written after a conference with you and Mr. Kremer.

Yours very truly,

N. B. MacKelvie

NBM..S

Enclosure

JLB

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

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Sept. 16, 1913.

Mr. F. G. Janney,
Manager of Mills,
Utah Copper Co.,
Salt Lake City, Utah.

Dear Sir:

Complying with your request of Sept. 3rd I have gone over the attached correspondence with Mr. Shimmin, and have endeavored to show in this letter our opinion as to Mr. Hyde's connection with the flotation process.

We have gone back over the early records and correspondence in connection with the subject and, with the exception of three or four free hand pencil sketches cannot find in the files any drawings, blueprints or designs of any description which were gotten up by Mr. Hyde, nor any that bear Mr. Hyde's signature of approval, nor can I find any record of his having submitted any detailed drawings of flotation machines or flotation installations of any kind.

In numerous letters Mr. Hyde refers to the preparation of plans and to the various schemes which he had in mind but there is no record of any finished drawings having been submitted which could have been used in the erection and installation of machines of his design. The sketches, notes, etc., which Hyde did submit to this company are on file and originals or copies of

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them can be forwarded to you should you desire them, but they are for the most part free hand, without dimensions and decidedly incomplete and they bear very slight resemblance to the machines now operating.

It is very evident from the early correspondence in this matter that from the beginning of Mr. Hyde's connection with this company a great amount of difficulty was experienced in obtaining from him any definite design or description of the type of machine which he desired them to install in the first place, and after the original machines were erected and failed to produce the desired results, his suggestions for improvement were decidedly hazy and intangible and consisted principally of criticism of the installation as it existed rather than instructions for improvement.

These conditions existed from the first, but copies of letters written to Mr. Hyde by Mr. Atwater indicate a willingness on the part of the Butte & Superior to follow Hyde's instructions on the first installations, as the flotation problem was entirely new to any connected with the company. The difficulties encountered in obtaining satisfactory results from Hyde's work is shown in the following paragraph quoted from Mr. Atwater's letter to Captain Wolvin under date of Oct. 4th, 1911, a signed copy of which is in our files:

"Hyde has proved to be an excellent theorist, but a very poor practitioner. His process, I am sure, is all right, but Collins and his men have had to put it into shape to run and Hyde's repeated

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mistakes in the design of apparatus and his inattention to minor, though important, details have consumed a good deal of unnecessary time. I have always given him a free hand and made it a point not to interfere in any way with his plans and projects, except as to their magnitude, but recently while discussing the failure to work properly of several features of his old and new plants, he said that he did not consider himself to be a practical man in any respect; so I proposed that he explain his process fully to Collins and leave all further points of construction as well as details of operation to Collins with Hyde acting as an advisor only and not as an administrator as heretofore. Hyde gladly accepted this arrangement. He and Collins got along very well together and I think that henceforth there will be fewer jobs in his department that will have to be done twice or three times before they are correct."

- You will note that this letter was written less than three months after the closing of the contract. This shows clearly the difficulties which were experienced in obtaining satisfactory results from the first machine erected, and it was only by repeated alteration and rebuilding that the machine produced any results at all. About three months later, or in February of 1912, Mr. A. H. Rogers made a test of the flotation installation at the Basin plant and in conclusion on Page 23 of Mr. Rogers' report, dated March 5th, 1912, he says:

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"The process has shown to be well adapted to the treatment of the Butte & Superior ore, even as carried out in the apparatus installed at Basin. It is believed, however, that there is room for improvement in ~~their~~ ^{this} apparatus attaining thereby both improved metallurgical and economic efficiency. Experiments to decide the best type of apparatus are strongly recommended before deciding on the design of apparatus to be installed in the new mill. It appears therefore that there will be a very decided advantage in the use of the process in the new mill but no time should be lost in deciding on the form of apparatus to use."

During the early part of 1912 there was considerable correspondence between Mr. Hyde and Mr. Atwater discussing various designs which both had in mind leading up to a cablegram from Hyde who was then in London. This cablegram is dated July 30th, 1912, and reads:

"Am forwarding plans new pumpless machine on one level. Await these before building new machine."

(Signed)

Hyde.

The plans referred to were those referred to in his letter from London the following day in which he says:

"I am enclosing herewith a sketch with dimen-

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sions for a new flotation machine for the uncompleted side of the mill. It is along a line discussed between myself and Mr. T. J. Hoover over a year ago. . . . Referring to the sketch you will note that the machine consists of a number of agitators and overflow boxes built together into a single continuous tank through which the froth flows in a practically straight line."

The machine referred to in this correspondence was built as shown by Mr. Atwater's letter to Mr. Hyde dated Aug. 27th, 1912, in which he says:

"I also have for acknowledgment your cable of July 30th requesting that we await for plans of new pumpless machine. Your letter describing the new machine and enclosing sketch of same arrived in due time. We have five cells complete according to your drawing and are now putting them into place. The grave doubt that I have in my mind that the machine will work is caused by the small settling area of your spitzkasten."

In this letter Mr. Atwater goes on to explain to Hyde a number of improvements which they had made in the machines then operating and in conclusion says:

"At the Butte Reduction Works the Minerals Separation have built a machine just like the drawings that you sent me excepting that they have a spitzkasten in front of every cell and the propellor in each cell acts as a suction for the feed from the spitzkasten back to the next propeller. I believe

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this will be an improvement over yours because it looks to me as though there would be a heavy deposit in each spitzkasten as you have drawn them; but if the machine will work the advantages of doing away with the pumps and more uniform flow through the machine are so obvious that we will try it as soon as we can."

The machine referred to in this correspondence was at that time being built according to Mr. Hyde's sketch as nearly as possible. It consisted of six agitators in one row while the spitzkastens were inserted between the agitators so as to form one continuous line of boxes. The depth of the spitzkastens was designated as 16 inches below the water line and this machine bears scarcely any resemblance to the one now in use.

On Sept. 11th, 1912, Hyde answered Mr. Atwater's letter of August 27th by submitting two additional sketches showing a machine having the same identical type of spitzkasten but the agitators and spitzkastens were placed in separate lines or rows and connected by means of 6" pipes so that the pulp might flow alternately from an agitator to a spitzkasten and thence to the following agitator. This change in design was produced by Mr. Hyde principally to make it different from the one which the Minerals Separation were building at the Butte Reduction Works but in this letter Hyde did not attempt to explain to Mr. Atwater why any of the difficulties which Atwater anticipated

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would not result after the machine had been completed. In fact he offered absolutely no suggestions except one taken from an old report of Froment's in which he suggests a revolving rake in the spitzkasten to prevent the coarse material from settling.

On November 9th, 1912, Mr. Atwater wrote to Hyde who was then in New York on his way home from London. In this letter Atwater says:

“.....The flotation unit which we built in accordance with the drawings you sent us from London did not work out at all. The pulp would not float through the machine and if it had flowed through the machine the spitzkasten would have been much too small to allow the concentrate to rise as well as in the old machine. I think before you left here we had begun to install 8' spitzkasten in place of the shorter ones and the spitzkasten on the new machine were much smaller than those on the original machine.”

He also goes on to say that difficulty was still being experienced with the treatment of slimes and that the Minerals Separation at the Butte Reduction Works were having the same trouble: “to-wit:

a very high oil consumption and a very poor recovery whenever the percentage of slimes in the feed becomes great. Green has been running a number of tests on the flotation feed to determine a benefit derived by allowing the pulp to stand for a period of time in contact with a weak

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solution of acid before treatment. He finds that whenever he allows the flotation pulp to stand for an hour or more with addition of two pounds of acid per ton of solids that he gets a good tailing and a good concentrate in the laboratory machine, regardless of the percentage of slimes and using from four to six pounds of oil per ton of ore. His tests have been so successful that we are now preparing to handle the mill pulp in this manner."

He then goes on to explain the method of operating the settling tanks which it was expected would give the desired time for acid bath and in conclusion he says:

"I would like very much to have your opinion on the above mentioned points. We will get more slimes into the flotation plant from the North side of the mill than we are now getting from the South side and I think that the flotation heads will be much lower in grade, therefore the outcome of the acid digesting scheme is of material interest."

In reply to this letter Mr. Hyde wrote from the offices of Hayden, Stone and Company, New York, under date of Nov. 18th, 1912:

"Your letter of Nov. 9th was received. I am sorry to hear that you still have trouble with the treatment of slimes and think that the pro-

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longed treatment of weak acid which you suggest is very likely to be helpful. In the final adjustment of the plant, however, one of the most vital matters to be arranged will be to have the crushing so adjusted that an absolute minimum of slimes will be made."

Nothing further in the way of suggestions, advice or criticism is offered in the remainder of this letter and Hyde does not refer in any way to Atwater's statement that the flotation unit, which was built according to Hyde's design, had proven an absolute failure even though he acknowledges receipt of the letter containing this statement. In the latter part of the letter, which consists mainly of a discussion of the possible value of pine tar oil, Mr. Hyde says:

"I will leave here within a few days on my way to California and will stop off at Butte and see if I can be of any further assistance to you."

About that time my own personal knowledge of the matter began and I recollect very clearly that Mr. Atwater discussed the situation with me, outlining the various events indicated by the correspondence quoted from, and it was very evident at that time that Mr. Atwater had practically abandoned the idea of obtaining any satisfactory results from Hyde's design or his advice or his presence at the plant. Neither Hyde nor anyone here at that time could give the reasons for the inefficiency of the flotation

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plant as it was considered more or less of a mystery among all concerned, except Shimmin, who told me upon my first visit to Butte in November that he and Peterson "could fix up flotation if the bunch would give them a chance."

The scheme for time treatment of slimes mentioned in Mr. Atwater's letter of Nov. 9th was a plan suggested by Shimmin and he had Green do the first work on this proposition, and submit a report together with a proposed flow sheet which would admit of time treatment of slimes by acid. Shimmin worked with Green on this proposition for some time and it was a modification of this plan which represented the final solution of the problem of successfully treating slime material in the flotation plant.

Shimmin saw the Hyde machine operating, or rather was present during several attempts to make the machine run, and he states that it was absolutely impossible to get a flotation pulp of any consistency to flow through the machine and that the action of the agitators in the agitator cells threw most of the feed out of the machine altogether. You will note that this was Hyde's design of a machine for the uncompleted side of the new mill. The machine which was then operating in the other side of the mill consisted of three spitzkastens on the rougher side and three on the cleaner side. I do not know just what the original installation in the new mill consisted of but the equipment which was operating in October and November of 1912 had at that time been altered, remodeled and

Plaintiff's Exhibit 9.

torn out and rebuilt a number of times since the beginning of operations in June and none of the arrangements which had at this time been devised and proven in any way satisfactory. There was nothing in the results being obtained at that time which would indicate any likelihood that a 90% recovery and a 50% concentrate would ever be obtained by the use of the flotation process in connection with the jigs and tables.

There is nothing in the correspondence or sketches on file to indicate the truth of Mr. Hyde's statement that for the new mill he had planned to use two four-spitzkasten machines with 36" cells, gear driven, together with two three-spitzkasten 28" cell gear driven machines from Basin. There are several sketches of double 3-cell machines but the first 4-cell machine shown is the cleaner which was designed in December, 1912.

Regarding the 28" cell machines at Basin which Mr. Hyde states were abandoned and left at that place, although they were in first class condition, appear to have been left at Basin by direction of Mr. Hyde as on May 24th, 1912, Hyde wired Mr. Atwater from New York as follows: "Want machine left at Basin if possible without involving any complications by leaving it open to inspection."

In December of 1912 when you were here with Mr. Jackling and Mr. Bradley on the way to Alaska, Hyde was here also and at that time there were two machines designed by Mr. Bradley who put into logical form the recommendations of Mr. Hyde. One of these machines

Plaintiff's Exhibit 9.

was the fifty ton test machine which was later partly erected but not finished on account of our work in connection with the big machines having shown that the fifty ton test machine was in no way adaptable to the work it was expected to do. This test machine is in no way similar to the large machines now operating but was considered by Mr. Hyde as the acme of perfection and was built from plans approved by him. The other machine designed at that time was the 4-cell cleaner machine which caused us so much trouble during January and February. This consisted of four agitators and four spitzkastens but the type of spitzkasten was entirely incorrect in that it was too wide along the overflow weir and too short when measured from the agitator side to the weir so that we found it actually produced at times a lower grade of concentrate as a finished product than was produced on the first and second cells of the rougher machine of local design which was then operating in connection with the cleaner. This cleaner machine was built absolutely according to drawings gotten up by Mr. Bradley and with Mr. Hyde's approval and it was operated, if I remember correctly, until we shut down in April to remodel the whole flotation plant.

At the time of Mr. Hyde's visit in December neither the mill nor the flotation plant were doing satisfactory work on account of the fact that we were changing from the old section to the new or remodelled section of the mill. In my report covering the first ten-day period of December I stated

Plaintiff's Exhibit 9.

"Operations were somewhat irregular and results a little erratic due to the starting of Section Two and closing down of Section One on the third and fourth of the month."

In Hyde's letter he enumerates the tailings assays of December 8th, 9th and 10th showing the difference between the flotation tailings and the general mill tailings. These assays were correct so far as the samples were concerned but they did not represent the actual work of the plant as mineral was accumulating in all portions of the mill such as the new elevator pits, new 40' settling tanks and other places so that the flotation plant received a much smaller tonnage of actual mineral during the first few days of operation of Section Two than was represented by the tonnage taken in at the head of the mill. This is shown by the fact that the tailings on the 11th averaged 8.1% and the average for the month of December was 7.1% in addition to which there was an under-run for the month of 676,000 lbs. of zinc which would represent a 1% higher tailing than the assays indicated on account of mineral accumulated in various portions of the mill.

The alterations mentioned in Mr. Hyde's letter which were at that time agreed upon consisted of the installation of the new cleaner machine of his design and the installation of a few additional potform pumps of Hyde's design to take the place of the air lifts or to assist them in handling the feed. Contrary to Mr.

Plaintiff's Exhibit 9.

Hyde's statement as to the results obtained during January there was an improvement in recovery during that month as compared with December. During December the mill produced 3,985 dry tons of zinc concentrate averaging 47.8% representing a recovery of 61%. In January the mill produced 5,604 dry tons of zinc concentrate averaging 47.6% zinc which produced a recovery of 68% showing that the net increase in recovery was approximately 7%. The high grade of averaged general tailings in January was caused partly by a larger tonnage being treated but was principally due to the intermittent operation of the flotation plant and also to the retreatment of a large quantity of slimes which had accumulated in the 40' settling tanks during December and the first part of January. You will recollect that at the time of your visit here with Mr. Janney, Jr., in January, after your return from Alaska, we were having trouble with the Garfield tables and among other changes made by Mr. Janney, Jr., at that time he had the riffles changed on these tables, increased the slope of the decks and made other changes which greatly improved their work. This materially improved the work of the entire mill, relieved the flotation plant of considerable mineral and by making a very large recovery of coarse concentrate at the expense of the grade we were able to show an improvement in the estimated recovery of the entire mill. The operation of the tube mills on Section One mentioned in Hyde's letter was not suggested by him as we had previously

Plaintiff's Exhibit 9.

taken this matter up with Mr. Janney, Jr. I recall that at that time Mr. Hyde was complaining that the material for flotation treatment was not ground to the correct fineness and that there was also too much slime in the flotation feed and his suggestion to Mr. Janney, Jr., in my presence was that all feed to the flotation plant be ground through 50 mesh. In the discussion which took place about that time between Green and Hyde and others, it was deemed essential by all concerned that the flotation feed consist of a combination of various sizes of sand together with a limited amount of slime. It was the general impression at that time that neither a slime feed nor an entirely sand feed was desirable but that a mixture of various sizes was required, the theory being that the coarse particles assisted in bringing up the fine particles of mineral and also admitted of more rapid settling of the silicious portion of the pulp. It was for that reason that Hyde stated that he believed the best results might be obtained by grinding through 50 mesh instead of grinding finer on account of finer grinding producing too large a proportion of slime for flotation treatment. This is quite contrary to Hyde's original report in which he states that best results would be obtained by grinding through 150 mesh screen in order to obtain an ultimate recovery of 90%.

All of the improvements made in the flotation plant such as the addition of spitzkastens, rearrangement of flow, etc., made during the first three months of 1913, were made by direction of Mr. Janney, Jr., These were

P. 4943, L. 4, insert "suggestion or a single" after
"single"

Plaintiff's Exhibit 9.

improvements suggested by him or improvements suggested by the boys at the plant and approved by him.

I cannot recall a single criticism made by Hyde which upon being adopted represented a permanent and positive improvement and I am quite confident that had the operation of the flotation plant been left in sole charge of Mr. Hyde it would be today in the same chaotic condition that it was in at the time I first saw the plant in October. Had Hyde been capable of producing equipment for a flotation process and of operating the equipment after it was installed there had surely been ample time and ample opportunity allowed prior to December 1st, 1912. Even though he was not given direct charge of the operations after that date, it would have still been possible for him to have designated^{ed} and erected a machine of correct arrangement had he been capable of doing so.

During March and the first part of April a tremendous amount of work was done in an experimental way in order to determine every weak point in the mechanical arrangement of the plant and also to determine the exact requirements for correct flotation treatment. In this work those of us at the plant consulted no one except yourself and Mr. Janney, Jr., and while Mr. Hyde did make a few recommendations to me, I referred them to Mr. Janney, Jr., and I am free to state that I cannot recall a single one of his recommendations having been adopted except the addition of acid at the sludge tank along the lines originally proposed by Mr. Shimmin several months before that.

Plaintiff's Exhibit 9.

The design of the machines which are now operating did not seem to be along the lines desired by Mr. Hyde and so far as I know did not originate from any plans submitted by him. You will remember that you had Mr. B. A. Mitchell from the Utah plants here at the time and that he designed the gears and gear case, making it possible to install a gear drive which did not have the objection of excessive noise which the previous installations had been burdened with. I remember that this gear case was your own idea as I was present at the conference we had in the hotel one evening when this and other matters in connection with the design of the machine was being taken up. The present ribbed liner for the agitation cells was of your design and I think originated from a suggestion made by Peterson and Shimmin as they had been doing experimenting with wooden baffles in the cells before your visit at that time. The spitzkastens now in use on the No. 1 rougher are remodelled spitzkastens remaining from one of the earlier machines but those on the No. 2 rougher are entirely different from anything which had been built before and entirely unlike any sketch or design which had ever been submitted by Mr. Hyde. Both of these roughers have since been provided with one additional spitskasten of the new style which has added greatly to their efficiency. The cleaner machine was provided with new style spitskastens and the new style liners in the agitation cells.

For the first time in the history of flotation opera-

P. 4945, L. 5, insert " up to that time it had to produce a rough concentrate " after " but "



Small, faint text or markings along the right edge of the page, possibly a page number or a reference code.

Plaintiff's Exhibit 9.

tion here we began using the system of producing a middling product on the 3d and 4th rougher cells after the remodelling. This scheme had been experimented with somewhat during March but on all spitskastens of the rougher machine and this rough concentrate was sent to the cleaner for retreatment. Since April we have been making a middling product on all spitskastens of the rougher machine except the first two which produce a rough concentrate for retreatment in the cleaner. The middling products from the other spitzkastens are about the same class of material as the tailings from the cleaner machine and these products are combined and returned to a tube mill for regrinding. New methods of adding oil and acid were also devised at that time and in fact the whole process was given a complete and thorough remodelling along radically different lines from anything which had heretofore been submitted. These changes were made entirely without consultation with Mr. Hyde, so far as I know, and were, for the most part, made without his knowledge. He had absolutely nothing to do with the success of the remodelled plant and from his remarks at the time he did not anticipate successful operation from the new arrangement. Since his departure from the plant, additional improvements and new methods of operation have been devised which has brought the flotation plant up to its present efficient condition, which is the production of a 50% concentrate and a recovery of 90% of the total metal content when operated in connection with the jigs and tables which is the

Plaintiff's Exhibit 9.

result which Mr. Hyde stated could be obtained by the use of a process according to his plans.

So far as Shimmin and I were personally concerned, our association with Mr. Hyde was always most pleasant but even though neither of us knew anything of the flotation process at first, his advice and instruction was of very little assistance to us in obtaining a personal knowledge of flotation. I believe we all obtained more benefit from the reading of Hoover's book on flotation than we did from association with Mr. Hyde as his advice was rather unreliable and his opinions varied from day to day and his description of mechanical arrangement rather vague so that it was difficult to arrive at any personal opinion regarding any phase of the process from the information obtained from Hyde. I know that both Shimmin and Green, as well as the operators in the plant, considered Hyde's presence detrimental and had no confidence in his ability to remedy defective conditions and I am also certain that his services were actually harmful in that he knew so little of the process as to cause his advice to be actually misleading.

Yours very truly,

F. R. Wickes

Mill Superintendent.

FRW/FT

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 10.

HAYDEN, STONE & CO.

Bankers

NEW YORK-BOSTON

NBM-K

New York, Mar. 1, 1913.

Mr. Allen H. Rogers,

C/o Butte & Superior Copper Co. Ltd.,

Butte, Montana.

Dear Sir:

Under date of February 6th, I received a bill from Mr. J. M. Hyde, which I am enclosing your herewith, amounting to \$601.70, for expenses which I understand are in connection with the litigation of the flotation process.

In the contracts that we have with Mr. Hyde, I cannot find any reference to providing for these payments, but I understand from Mr. Babbitt that the company agreed to assume these and Hyde also points this out in previous accounts rendered in the early part of 1912, so will you kindly have instructions given for a check to be sent to Hyde, at 1041 Shattuck Ave., Berkeley, Cal., for the enclosed bill?

Yours very truly,

N. B. MacKelvie.

Plaintiff's Exhibit 10.

BUTTE AND SUPERIOR COPPER COMPANY,
Ltd.

Jan. 29, 1913—191—

AUDITOR:

Pay to James M. Hyde,
For the Items and amounts listed below:

Room & Meals New York Oct. 9th to Nov 13, 1913, Incl.	\$245.00
Carfare, Baggage & Telegrams, etc., in New York	17.50
Fare New York to Butte	75.50
Hotel, etc., Butte on Return Trip	55.50
	<hr/>
	\$393.50
Round trip Berkeley to Butte January & February 1912	100.00
Thornton Hotel	85.70
Incidental meals, carfare, baggage, etc.	22.50
	<hr/>
	\$601.70

Approved

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 11.

BUTTE AND SUPERIOR COPPER COMPANY
Limited.

Butte, Mont., March 6, 1913.

VOUCHER

PAYABLE TO James M. Hyde, \$601.70
SIX HUNDRED ONE and 70/100 DOLLARS
Approved for Payment Approved for Payment

..... C. M. Everett

DETAILS OF VOUCHER

As per statement of Jan. 29th, 1913 and Mr.
MacKelvie's letter of March 1st, 601.70
Entered
Ledger

DISTRIBUTION

ACCOUNTS PAYABLE

.....
.....
..... 601.70
No. 5958

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 12.

BUTTE AND SUPERIOR COPPER
COMPANY
Limited

Butte, Montana, March 6, 1913.

No. 5958

Pay to the Order of James M. Hyde, \$601.70
SIX HUNDRED ONE and 70/100 . . . DOLLARS
BUTTE & SUPERIOR COPPER COMPANY, Ltd.
By C. M. Everett

To The Special
FIRST NATIONAL BANK
Butte, Montana

(Paid Mar 17 1913)

(THE FIRST NATIONAL BANK
OF BUTTE MONTANA)

(Endorsed)

Your endorsement hereon constitutes receipt in full
for account as per statement which you have detached
from this check.

James M. Hyde

Plaintiff's Exhibit 12.

(Pay to the Order of ANY BANK OR BANKER)
(All Prior Endorsements Guaranteed)
(FIRST NATIONAL BANK)
(90-42 Berkeley, Cal. 90-42)
(MORTIMER, Cashier)
(Mar. 11 1913)
(PAID Mar 17 1913, STATE SAVINGS BANK)
(BUTTE, MONT.)
(PAYING TELLER)

(PAY TO THE ORDER OF ANY BANK,)
(BANKER OR TRUST CO.)
(Previous Endorsements Guaranteed)
(UNION BANK & TRUST COMPANY,)
(93-29 BUTTE, MONT. 93-29)
(R. O. Kaufman, Cashier)

(Pay to the Order of Any Bank or Banker,)
(Prior Endorsements Guaranteed. C MAR 11 1913 Z)
(CALIFORNIA NATIONAL BANK,)
(Sacramento, Calif.)
(FRED W Cashier)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit 13.

AUDIT BILL
BUTTE AND SUPERIOR COPPER COMPANY,
Ltd.

Apr. 30, 1913—191—

AUDITOR:

Pay to James M. Hyde, 1041 Shattuck Ave.,
Berkeley, Calif.

For the items and amounts listed below:

Expense account Jas. M. Hyde during months of
March and April, 1913, in connection with Mill
and Patent Suit as per attached \$325.65

Chgd

H. A. Atloff (?)

Approved: J L B

Expense Account of James M. Hyde in Attendance on
Mill and Patent Suit. March and April 1913.

San Francisco to Butte and return Ticket,
Pullman, Meals, etc \$112.25
Thornton Hotel 181.90
Lunches and incidentals 18.75
Supplies, expressage, etc. in connection with suit 12.75

\$325.65

O.K.

J.L.B.

Plaintiff's Exhibit 13.

BUTTE & SUPERIOR COPPER COMPANY
LIMITED

Butte, Mont., May 2nd, 1913.

VOUCHER

PAYABLE TO James M. Hyde, . . . \$325.65

Three hundred Twenty five and 65/100 . . . Dollars

Approved for Payment

Approved for Payment

.....
C. M. Everett

DETAILS OF VOUCHER

As per expense bill of April 30th, 1913

in connection with Mill and Patent Suit. 325.65

.....
Entered
Ledger

DISTRIBUTION

ACCOUNTS PAYABLE

.....
.....
325.65

No. 6323

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 14.

Seal on car So. 15679.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 15.

Memorandum of car.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 16.

Bag containing concentrates.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 17.

Bottle containing concentrates after treatment.

(Physical Exhibit)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiff's Exhibit 18.

Admitted.

Third Annual Report of Butte & Superior Company.

Part admitted and read in record and withdrawn by plaintiff.

MR. GARRISON: (Reading) "The litigation in connection with the Minerals Separation, Limited, which, at the date of the last annual report was pending and undecided on appeal, in the United States Circuit Court of Appeals at San Francisco, has since that time been decided in favor of your company by the Court of Appeals holding the patents of the Minerals Separation Company, Limited, as absolutely void. This question has been taken to the Supreme Court of the United States, where it is now pending, and a decision cannot reasonably be expected before some time in the spring or summer of 1916. Your directors have no reason to modify to any extent the expressions in the last annual report regarding the final outcome of this litigation. Respectfully submitted, N. Bruce MacKelvie."

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit 19.

Admitted.

Advertisement in Mining & Engineering World,
December 30th, 1916. Page 12.

Mining and Engineering World

THE FLOTATION PROCESS

All rights under this process in North America
are now controlled by

MINERALS SEPARATION NORTH AMERICAN
CORPORATION

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting of licenses for future use of the process.

Notice is also given that the Company will enforce its patents and will stop all infringements.

The Company maintains a laboratory for testing ores by flotation, and samples sent to its Chief Engineer, Mr. Edward H. Nutter, at its San Francisco address will be tested at minimum expense to prospective licensees. No one else is authorized to represent the

Defendant's Exhibit 20.

Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 20.

Admitted.

Copy of Mining & Engineering Journal,
December 23rd, 1916. Page 35.

THE FLOTATION PROCESS

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Defendant's Exhibit 20.

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MINERALS SEPARATION NORTH AMERICAN
CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit 21.

Admitted.

Page 55, of Salt Lake Mining Review,
January 15, 1917.

THE FLOTATION PROCESS

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CORPORATION

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Defendant's Exhibit 22.

sent the Company or to introduce its process and apparatus into the United States, Canada or Mexico.

MINERALS SEPARATION NORTH AMERICAN CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit 22.

Admitted.

Page 15 of Mining & Scientific Press,
January 6, 1917.

THE FLOTATION PROCESS

All rights under this process in North America
are now controlled by
MINERALS SEPARATION NORTH AMERICAN
CORPORATION

The Supreme Court of the United States having established the validity of the basic patent for froth flotation, notice is renewed that the Company is ready to grant licenses for the use of this process to those who wish to install and use it.

To those who have infringed the patent, notice is given that a settlement for past infringement must

Defendant's Exhibit 23.

precede the granting of licenses for future use of the process.

Notice is also given that the Company will enforce its patents and will stop all infringements.

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MINERALS SEPARATION NORTH AMERICAN
CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway

New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit 23.

Admitted.

Page 10 Boston News Bureau, February 21, 1917.

THE FLOTATION PROCESS

All rights under this process in North America
are now controlled by

MINERALS SEPARATION NORTH AMERICAN
CORPORATION

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Defendant's Exhibit 23.

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MINERALS SEPARATION NORTH AMERICAN
CORPORATION

Merchants Exchange Building
San Francisco, California.

61 Broadway
New York, N. Y.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy

Defendant's Exhibit 24.

Admitted.

Page 14 New York Commercial
January 15, 1917.**MINERALS SEPARATION FLOTATION
PROCESS**

The flotation process for the concentration of ores is the latest and greatest invention in metallurgy. It has revolutionized the art of concentrating the ores of zinc, lead and copper. It gathers up with these metals the traces of gold and silver found associated with them and it has even entered the domain of purely gold ores. It has changed the metal values in great mounds and hills of dumps, previously rejected as worthless, into dollars and pounds sterling. It has not only reclaimed the waste of the past, but is preventing the waste of the present. The leanest ores and dumps are now made to yield their medium of values to this process on easy terms of substantial profit, and the yield from ordinary mining operations has in many instances been raised from modest earnings to fabulous profits.

MODE OF OPERATION

This marvellous invention utilizes little bubbles of air coursing through a muddy ore pulp of finely ground ore and water, to pick out and attach to themselves the valuable metal particles and to repel and reject the useless particles of dirt, rock or sand, or as it is generally called, gangue. The metal particles and air bub-

Defendant's Exhibit 24.

bles once united cannot be separated. Each little air bubble gathers up a load of metallic particles, and when given a reasonable opportunity will float them to and through the surface of the pulp and form, resting upon the surface of the pulp, with other metal laden bubbles, what is in fact a water-air froth of metal carrying bubbles. Air bubbles and froth, the very symbols of things transitory and useless, have now been harnessed to the service of man as persistent and reliable agents to carry out his will in a manner bordering on the miraculous. On a quiet surface the froth persists for days. In practice the froth may be adjusted to such persistence as will assure that the froth will overflow from the top of the liquid, pushed along by constantly rising bubbles and new forming froth, and safely carrying the metallic particles into a launder or trough, ready for the smelter.

PRACTICAL ADVANTAGES

By this process concentrates of any desired richness may be obtained, with a recovery so high that it was proved in one of the litigations involving the process that its adoption by five of the leading porphyry copper mines of the United States would effect a yearly saving at normal market prices (not war prices) of at least \$17,000,000.

ORDINARY WATER CONCENTRATION

The metallic particles are usually considerably heavier than the gangue particles. Therefore in the

Defendant's Exhibit 24.

ordinary process of ore concentration advantage is taken of this fact to separate the particles by the difference in their sinking power in water. A great amount of machinery is used, principally jigs, shaking tables and vanners, all these machines depending upon this difference in sinking power. The gold miner's washing pan is the simplest example of this kind of gravity treatment. The new process, however, does the very opposite thing, it floats the heavy metallic particles above the surface of the water and permits the lighter rock or gangue particles to sink or to remain suspended in the water. It operates in fact, by picking out the heavier metallic particles and lifting them up out of the water.

HISTORY OF THE INVENTION

The flotation process was invented in March, 1905. in London, England, at the metallurgical laboratory of Minerals Separation, Ltd. The inventors are Henry Livingstone Sulman, Hugh F. K. Picard, and John Ballot. They were investigating a concentrating process invented by Arthur E. Cattermole, wherein by using oil in the proportion of from forty to one hundred and twenty pounds per ton of ore, the metallic particles were coated with a thin sticky film of oil and by agitation they were agglutinated together into larger agglomerates or granules which would reliably sink against a current of water sufficient to carry the gangue upward and away. This metal sinking process was in itself a great ^{advance} ~~advantage~~ in the art, since it saved

Defendant's Exhibit 24.

all the valuable metallic slimes (extremely fine particles necessarily produced in every crushing or grinding process) which in all other then known processes were carried away to waste with the gangue. They had studied this Cattermole metal sinking process for more than two years and were then erecting a concentrating plant at Broken Hill, Australia, to carry out the process on a large scale. They had improved the Cattermole process, and in improving it they had unwittingly assembled all the conditions for the froth ^{flotation} ~~agitation~~ process, even including an abundant aeration of the pulp, although that aeration was a useless incident of the violent agitation necessary for the Cattermole process as carried on in the type of agitation vessel which they used. Having developed and largely improved the Cattermole process to a working basis, they decided to carry out a series of experiments investigating all of the factors of that process, and as a part of this investigation to reduce the amount of oil step by step, observing the results and pursuing the investigation to the vanishing point. This work was carefully, systematically and well done under their instructions by one of the staff of Minerals Separation, Arthur Howard Higgins, an able metallurgist, who has since contributed largely by his inventions to the improvement of the process. As the amount of oil was diminished below Cattermole proportions, the Cattermole phenomena disappeared and no effective sinking of metal was obtained and the results were worthless. Nevertheless the reduction was persisted in, and,

Defendant's Exhibit 24.

to the surprise of everyone a persistent metallic froth came to the surface. This, with the ore and oil used, reached its maximum in metal flotation with about two pounds of oil to the ton of ore, one-tenth of one per cent. of the weight of the ore, one part of oil to a thousand parts of ore. On examining this metallic froth it was found that the oil had disappeared from sight and touch and had lost all its ordinary qualities. Chemical investigation showed that it was upon the concentrates, but in a film, so attenuated that its presence could be detected only by chemical means. It was found that the oil when present in this minute quantity had the peculiar function of controlling the formation and action of the air bubbles so as to effect minute bubble formation and so as to assist the selective action of these bubbles for metallic particles, and so as to give practical permanency to the bubbles, both when immersed in the liquid and when gathered above the liquid in the froth.

THEORIES OF OPERATION

The explanation above given is the extent of exact knowledge of the process which repeated scientific investigations have determined. The process has not yet been fully explained. Numerous theories have been advanced, and at one time electrical theories were favorably regarded, but the complete explanation of the mysterious operations is yet to come. The inventors, however, having found out how to work the process, did not wait to discover why it worked, but immediate-

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ly put it to work, and the Cattermole plant in Australia was altered to carry on the new process. They also patented it practically all over the world.

METALLURGICAL PROBLEM AT BROKEN HILL, AUSTRALIA

There was at Broken Hill, Australia, a great accumulation of about twelve million tons of tailings of former workings, containing about twenty-five per cent of the metals, zinc and lead, with some silver, but with the gangue of substantially the same weight as the metals. The ordinary process of water concentration, which depends upon the difference in the sinking power of the metallic and gangue particles, could do nothing with these tailings. The Cattermole process was devised to solve this metallurgical problem, and might have done fairly well but for the discovery of the vastly better flotation process.

The new process was successful from the beginning, and its use in Australia rapidly extended.

BRITISH AND AUSTRALIAN LITIGATION

A competitor who had failed to solve the problem immediately commenced suit, first in England against Minerals Separation, and then in Australia, against one of the licensees, charging infringement of the earlier Elmore patents. The process disclosed in these patents required from one to three tons of oil to the ton of ore. The metal particles were entrapped in a mass of oil and floated by the buoyancy of the oil. That

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there was no resemblance between this process and the new air bubble flotation or froth flotation process was finally decided, first by the British House of Lords in the suit commenced in England, and again by the Privy Council of the British Empire in the suit commenced in Australia.

The growth of the use of the new process was retarded by this litigation, and its introduction into use in America was not undertaken until after the favorable decision of the House of Lords.

INTRODUCTION INTO AMERICA

Edward H. Nutter, an American mining engineer and metallurgist, was appointed Chief Engineer of the American Syndicate which undertook the work of introducing the process into use in North America. Before taking up his duties he studied the process in the London laboratories of the Company, and then went to Australia to study the extensive practical use of the process there. Early in 1911, he returned to America, organized a staff of metallurgists and commenced an active and successful campaign to bring the process to the attention of mine owners.

An American corporation has recently been formed, Minerals Separation North American Corporation, incorporated under the laws of Maryland, which now owns or controls all of the patents in North America. The directors of this Company are John Ballot, one of the inventors, who has in fact been at the head of the enterprise from the beginning; Dr. S. Gregory,

Defendant's Exhibit 24.

who has had general supervision of the work in America, and Frank Altschul, of Lazard Freres, bankers.

The process has been adopted under license from the patentees by many American mines, including the Anaconda (the greatest copper producer in the world), the Inspiration, Senator Clark's companies, the Britannia Mining & Smelting Company, Ltd., the Portland Gold Mining Company, the Vindicator Consolidated Gold Mining Company, and scores of others. The Inspiration plant is acknowledged to be the most modern of the great copper mills, and treats about 15,000 tons of ore per day and shortly will treat nearly 20,000 tons of ore per day. The installation of the flotation process at this mine effected an initial saving of more than a million dollars in the cost of installation, and has increased the capacity of the plant to more than double that of the plant originally planned at much greater cost, and has in fact converted the Inspiration mine from a moderately profitable to an enormously profitable venture. The Anaconda Company, upon adopting the process, reorganized and very nearly reconstructed its milling plant, replacing the cumbersome machinery of former processes by the simple machines of the flotation process, and increased its recoveries from 76% to 96%, while the capacity of the mill was increased from 12,500 tons to 16,000 tons per day.

Many new problems had to be worked out in applying ^{the} process to the American copper ores, and George A. Chapman, a metallurgist of Minerals Separation, Ltd., contributed several brilliant inventions in solv-

Defendant's Exhibit 24.

ing these problems. He is in fact to be credited with contributing largely to the successful installation of the process at Broken Hill, Australia, and at Inspiration and Anaconda mills in the United States.

The process has also been successfully installed at, and has proved an immense benefit to the Braden mines in Chili and the El Corbe^o mines in Cuba and many other mines in other parts of the world.

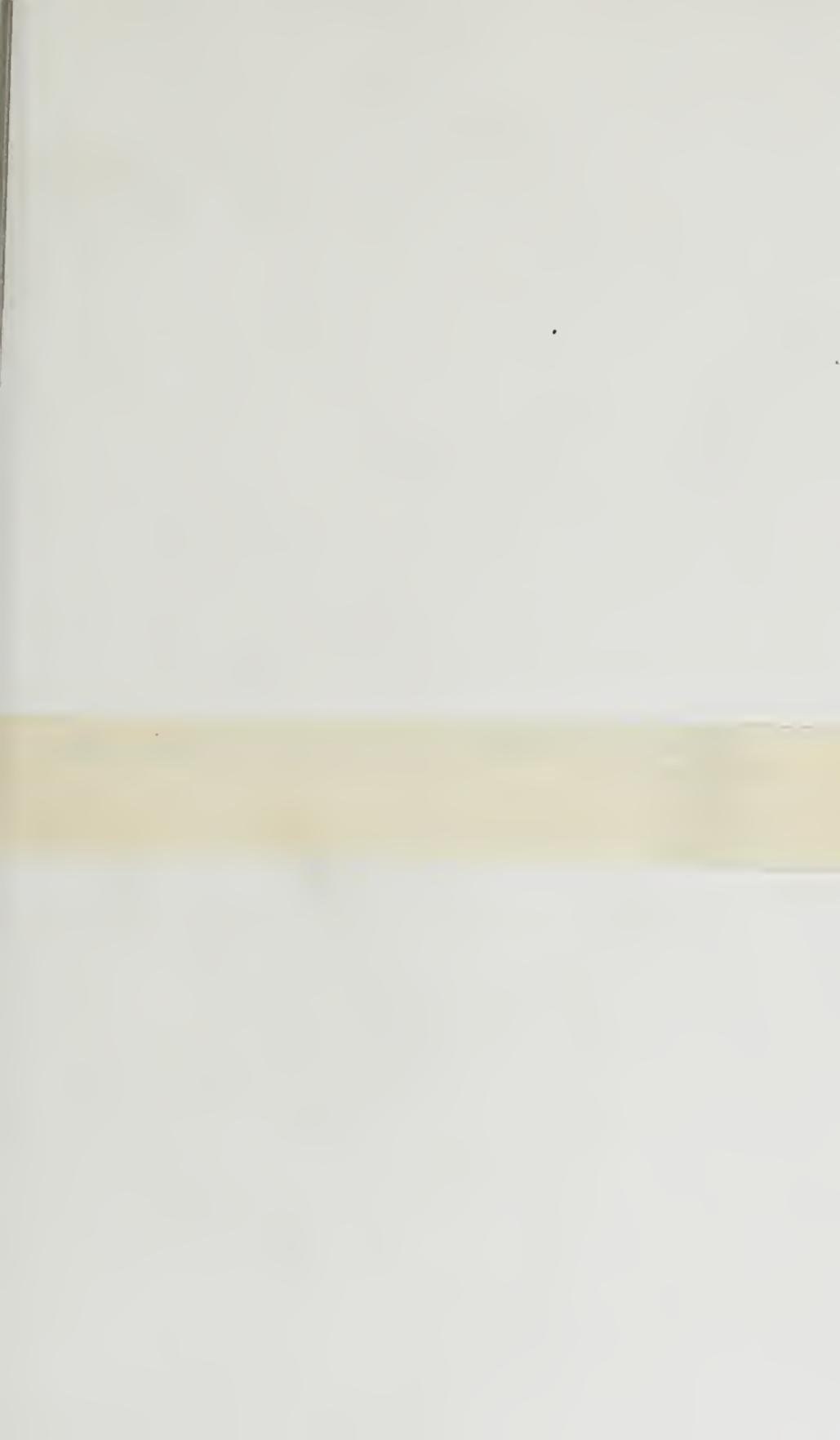
INFRINGEMENTS AND LITIGATION

A considerable group of American companies, notably the Jackling group of mines, determined to try out flotation without reference to the rights of the patentees. The first of these operations in defiance of the patents was carried on by the Butte & Superior Copper Company of Butte, Montana, now the Butte & Superior Mining Company, one of the Jackling group. They employed James M. Hyde, a former engineer of Minerals Separation, Ltd., for this purpose. He had been given by Minerals Separation, Ltd., all information and apparatus necessary to operate the process and sent to visit various important mines in Mexico and Canada, and while in America he was specifically instructed by Minerals Separation to go to Butte, Montana, with the object of helping the Butte & Superior Company solve its metallurgical problem. Instead of doing what he was instructed to do, he returned to London and terminated his connection with the Company. Thereafter he came back to the United States and went to the mills of the Butte & Superior Company and there installed the flotation process. The

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result was the suit of Minerals Separation v. Hyde, which was commenced in October, 1911, promptly after this installation in defiance of the patents, and more than five years later, on December 11, 1916, was finally decided by the Supreme Court of the United States in favor of the patentees. This suit was commenced in the United States District Court of Montana, and was there decided favorably to the patentees by Judge George M. Bourquin of that court, in July, 1913. The defendant then appealed to the United States Circuit Court of Appeals for the Ninth Circuit, sitting at San Francisco, California, and that court reversed Judge Bourquin's decision in May, 1914, and held that the patent was void. This was believed to be a final decision against the validity of the patent, and in fact the Department of Mines then announced that this wonderful process was now free to all. There was no right ~~to~~ appeal from this adverse decision, but the Supreme Court of the United States in exceptional cases reviews the decisions of the Circuit Court of Appeals in patent cases and the patentees succeeded in convincing the Supreme Court that this was a proper case for such review. In October, 1914, a writ of certiorari of the Supreme Court was issued, and the case was brought to that court for final determination, and argued and determined there as above noted.

A suit for infringement was also commenced against the Butte & Superior Company in 1913, but was held in abeyance awaiting the decision of the United States Supreme Court in the first suit. It will now be pressed



P. 4972, L. 17, insert "to the mining Community" after
"announced"

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to final adjudication. A suit has also been carried on against Miami Copper Company, a neighbor of the Inspiration mine, who decided to add flotation without obtaining a license, shortly after the successful demonstration of that process at the Inspiration mill. This suit was tried in Wilmington, Delaware, before Judge Edward G. Bradford. The trial occupied nine weeks, from March 29, 1915, until May 27, 1915, and was decided in favor of Minerals Separation on September 29, 1916. The important new point here involved and decided in favor of Minerals Separation, Ltd., was that flotation concentration as carried on in what are known as the Callow penumatic cells, is an infringement of the Minerals Separation's patents. The patent of Minerals Separation for a frothing agent which is not an oil and is soluble in water was also included in this suit and was held to be valid and infringed. This case has been appealed to the United States Circuit Court of Appeals for the Third Circuit, sitting at Philadelphia, Pennsylvania, and the appeal has been set for argument late in January, the Miami Company having given a bond for \$250,000 to stay injunction pending appeal.

A peculiar feature of the present situation is that the mines which have been licensed by Minerals Separation, Ltd., have paid small royalties and have themselves reaped enormous profits from additional recoveries largely at war prices, while the mines that have proceeded in defiance of the patents have run the risk of judgment against them for all of their additional

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profit, including their enormous war profits, attributal to the invention. The rule of law is that an infringer is to be treated as a trustee for the owner of the patent, and must account to the owner of the patent for all profits due to the invention. Further it is a fundamental principle of patent law that no one is permitted to use a patented invention without the consent of the patentees, and now that the basic patent has been finally sustained by the Supreme Court of the United States it is not to be expected that the patentees will permit the continuance of further operations in defiance of their patents.

Henry D. Williams, patent lawyer, of New York City, has conducted all of the American litigation from the beginning. William H. Kenyon of Kenyon & Kenyon, also of New York City, has been associated with him during the past two and a half years. In the Wilmington suit Thomas F. Bayard, son of late Ambassador and Secretary of State Bayard, is associate counsel. In the United States Supreme Court Lindley M. Garrison, now of New York, formerly Vice-Chancellor of New Jersey and later Secretary of War, and Frederic D. McKenney of Washington, D. C., are associate counsel. Odell W. McConnell of Helena, Montana, and John H. Miller of San Francisco, California, have also contributed their assistance in Montana and California in the efforts to sustain the patents and secure to the inventors that protection and reward guaranteed by our patent laws. It is to be remembered that these laws, like the copyright laws, were en-

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acted pursuant to the clause of the Constitution of the United States empowering Congress, "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

POLICY OF MINERALS SEPARATION

The policy of Minerals Separation has always been, aside from its own use of its process, to license the use of its process to all who wished to use it, and to give to its licensees the full benefit of all its experience, research and knowledge, and to receive as compensation a reasonable royalty based upon material treated or values recovered by its process. Thus its compensation is based only upon the extent of the use of its process, and is quite analogous to the royalty of an author or playwright. Royalty to inventor is as much a matter of equity and good conscience as is royalty to authors. Piracy of inventions is as reprehensible as piracy of literary work.

This policy of Minerals Separation has not met with serious opposition in any part of the world except the United States. Here it has been necessary to fight to the finish to establish its rights as against many of the users of its process. Abroad it was only necessary to fight an unsuccessful competitor.

SUMMARY OF ADJUDICATIONS

Out of all this litigation have come adjudications by the three greatest courts in the world as to the novelty

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of the froth flotation process. These courts are the Supreme Court of the United States, the British House of Lords, and the Privy Council of the British Empire, the latter being a court composed in each instance of a committee appointed by the Lord Chancellor from the Law Lords of the House of Lords. In the Minerals Separation case, Viscount Haldane appointed a committee of five, including himself. The House of Lords' decision was rendered by five other Law Lords, including the then Lord Chancellor, Lord Loreburn, and the Supreme Court decision was given unanimously by the full bench of nine justices. Thus the judgments and decisions express the conclusions of nineteen of the greatest jurists in the world. It is pleasing to note that the opinions of Judge Bourquin of Butte, Montana, and Judge Bradford, of Wilmington, Delaware, are in harmony with these great courts and were in fact followed by the Supreme Court of the United States. It is believed that the legal battle as to the rights of the inventors is now substantially completed.

ADJUDICATIONS AS TO THE NOVELTY OF
THE INVENTION

It has been repeatedly stated in the literature of flotation that Carrie J. Everson was the inventor of flotation. The fact is that her patent of 1886, discloses a metal-sinking process, in which the metallic particles are mixed with enough oil to make them lighter than gangue, but still heavier than water, and are separated

Defendant's Exhibit 24.

in suspension by reason of the fact that they do not sink as fast as the gangue. To use her own words: "The sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil and acid."

Her patent has now been considered both by the House of Lords and the Supreme Court of the United States, and the Supreme Court of the United States has agreed with the House of Lords that her patent does not disclose flotation. The following is an excerpt from the Supreme Court decision:

"It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the process^{of} of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it clear that the lifting force that separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than, and different from, that which had been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical. It results without more discussion that we fully agree with the decision of the House of Lords, arrived at upon a different record and with different witnesses, but when dealing with the

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equivalent of the patent in suit, in *Minerals Separation, Limited, v. British Ore Concentration Syndicate, Limited*, 27 R. P. C. 33. In this decision Lord Shaw, speaking for the court and distinguishing the process there in suit especially from the Elmore oil flotation process which had gone before, but which was typical of the then prior art said: "They (the patentees of the Agitation Froth Process of the patent in suit) are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid."

"And Lord Atkinson said: "In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of the air bubbles, which, introduced into the mixture by the more or less violent agitation of it, enveloped or becomes attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water."

Defendant's Exhibit 24.

"The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation, it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining companies of the world, notably in the United States, Australia, Sweden, Chile and Cuba, and that, because of its economy and simplicity, it has largely replaced all earlier processes. This, of itself, is persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect."

The Supreme Court of the United States and the Privy Council of the British Empire, have both considered the Criley and Everson publication in the *Engineering and Mining Journal* of 1890. The Privy Council said that their attention had been directed in considerable detail to this article and they found it so incomplete that it was not even sufficient to anticipate the Elmore patent (although the House of Lords had held the British Elmore patent anticipated by the Everson patent). They said of it:

"Even if the test process is not to be discarded as a failure, it does no more than give information that if to a greased mixture of pulverized metal and rock you add boiling sulphuric acid in sufficient quantity, in some way a differentiation is affected as between the metal and the gangue."

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To Carrie J. Everson is to be given the credit of having first discovered that in a process where oil is used to entrap the metal of an ore pulp and add buoyancy to it, an acid such as sulphuric acid will help to keep the oil off the gangue. In her patent she did not add enough oil to make the metal float. In what is described in the publication above referred to she may have done so, but the publication itself does not establish ~~the~~ ^{that} fact. If she did, she completely anticipated the Elmore oil-buoyancy metal-flotation process, but ~~what~~ was no nearer the froth flotation process than was Elmore with his minimum of ~~one~~ ^a ton of oil to a ton of ore.

~~The~~ other prior patents which have been relied upon to anticipate the froth flotation process are all disposed of by the decision of the Supreme Court of the United States. As that court says of all prior processes, including Everson:—

“All of which, speaking broadly, consisted in mixing finely ~~crushed~~ ^{crushed} or powdered ore with water and oil,*** and then in variously treating the mass—the pulp—thus formed so as to separate the oil, when it became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue.”

As otherwise expressed in the decision, before the froth flotation process was invented, oil was loaded with metal, and either floated the metal, as in Elmore, by what the Supreme Court calls the “Surface Flotation Process,” or sank the metal, as in Cattermole, by what the Supreme Court call the “Metal Sink-

Defendant's Exhibit 24.

ing Process". Everson, so far as disclosed in the patent, comes within the latter class.

As contrasted with the utilization of oil as a buoyant agent or as an agglutinating agent, the froth flotation process utilizes air bubbles as the buoyant agent and only utilizes oil to modify the air bubbles and make them persistent and increase their adherence to the metallic particles. The oil disappears from sight and touch, and the apparatus, except at the point of the introduction of the oil, remains as clean and as free from oil as though no oil ^{was} ~~was~~ used.

In Australia Minerals Separation and licensed users have produced by flotation over 1,800,000 tons of zinc, 350,000 tons of lead, and 40,000,000 ounces of silver.

EXTENT OF USE OF THE INVENTION

The following are among the principal licensees under Minerals Separation patents in North America:

Atlas Mining & Milling Co.

M. W. Atwater.

Anaconda Copper Mining Co.

Arizona Copper Co., Ltd.

Britannia Mining & Smelting Co., Ltd.

Burro Mountain Copper Co.

Broadwater Mills Co.

Brockmann & Co., Inc.

Cuba Copper Co.

Cusi Mining Co.

Consolidated Arizona Smelting Co.

Chicagoff Mining Co.

Defendant's Exhibit 24.

Doe Run Lead Co.
Desloge Consolidated Lead Co.
Dutch-Sweeney Mining Co.
Engels Copper Mining Co.
Flint Mines, Ltd.
Greene-Cananea Copper Co.
Highland Valley Mining & Dev. Co.
Inspiration Cons. Copper Co.
Mountain Copper Co., Ltd.
Mond Nickel Co., Ltd.
Mineral Recovery Co.
Old Dom. Cop. Mining & Smelting Co.
Pingrey Mines & Ore Reduction Co.
Phelps, Dodge & Co.
Portland Gold Mining Co.
Reward Gold Mines Co.
St. Joseph Lead Co.
Timber Butte Milling Co.
Utah Leasing Co.
Vindicator Cons. Gold Mining Co.
Weedon Mining Co., Ltd.

In North America, and principally in the United States, the use of the process has been carried on both by licensees and infringers. It is estimated that over 1,000,000 tons of ore were treated by the process during 1914, 5,000,000 tons during 1915, and about 25,000,000 tons during 1916.

In South America the Braden Copper Co. is the largest user of the Minerals Separation flotation pro-

Defendant's Exhibit 25.

cess. The Cerro de Pasco Mining Co., Corocoro United Copper Mines, Ltd., and the Societe des Mines de Cuivre de Caternau are also South American licensees.

There are also several licensees in Europe, but no statistics are available because of the war.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit 25.

Admitted.

HENRY D. WILLIAMS.

Attorney and Counsellor at Law.

Solicitor of Patents

61 Broadway (Adams Building)

New York, January 30, 1917.

Utah Copper Company,
600 McCormick Building,
Salt Lake City, Utah.

Gentlemen:

In behalf of my clients, Minerals Separation, Limited, of London, England, and Minerals Separation North American Corporation of 61 Broadway, New York, N. Y., you are hereby notified of infringement of my clients' patents for froth flotation concentration of ores, and particularly the basic patent for such a process, No. 835,120, issued November 6, 1906, to Sulman, Picard and Ballot, recently held to be valid

Defendant's Exhibit 25.

and infringed by the Supreme Court of the United States in the case of Minerals Separation, Ltd., and another against Hyde. I am enclosing a copy of the opinion and order of the Supreme Court and of the decree and injunction affirmed thereby with immaterial modifications. My clients are willing to grant licenses to those who wish to use their inventions, but before any consideration can be given to that matter, a full settlement for past infringements must be made, and this altogether regardless of whether or not you wish to continue to use flotation.

You are therefore hereby directed to send to me a full statement of your infringing operations in accordance with the interrogatories enclosed herewith, in default whereof I am directed to commence suit against you for an injunction, profits and damages, including a preliminary injunction at the commencement of the suit to immediately stop your infringing operations.

Yours etc.,

(Signed) Henry D. Williams.

2 encs.

Enclosed in letter from John M. Hays dated

Feb. 7, 1917.

STATEMENT OF FLOTATION OPERATIONS

1. Name of Company
2. Where incorporated
3. Home office address

Defendant's Exhibit 25.

4. Name of Mine
5. Mine address
6. (a) Is mine in operation
(b) Is mill in operation
7. (a) Present daily tonnage
(b) Expected daily tonnage
8. General character of ore
9. Principal sulphide minerals
10. Principal gangue minerals
11. Type and daily capacity of milling plant
12. (a) Is the flotation process in use or has it been used, experimentally or otherwise, in this mill
(b) For how long
13. What products are or have been treated by flotation
14. What is the total mill recovery
15. What proportion of total recovery is due to flotation
16. Number of tons treated daily by flotation
17. Total tonnage treated by flotation to date
18. Total concentrates produced by flotation to date
19. Average assay value of flotation concentrates
20. Gross market value of all flotation concentrates produced to date in this mill
21. Type and manufacture of flotation apparatus used in this mill
22. (a) Have any flotation tests been made on this ore
(b) If so, by whom

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23. On separate sheet, give complete details of flotation tests made

24. Remarks

Dated

Signed

Title

B

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

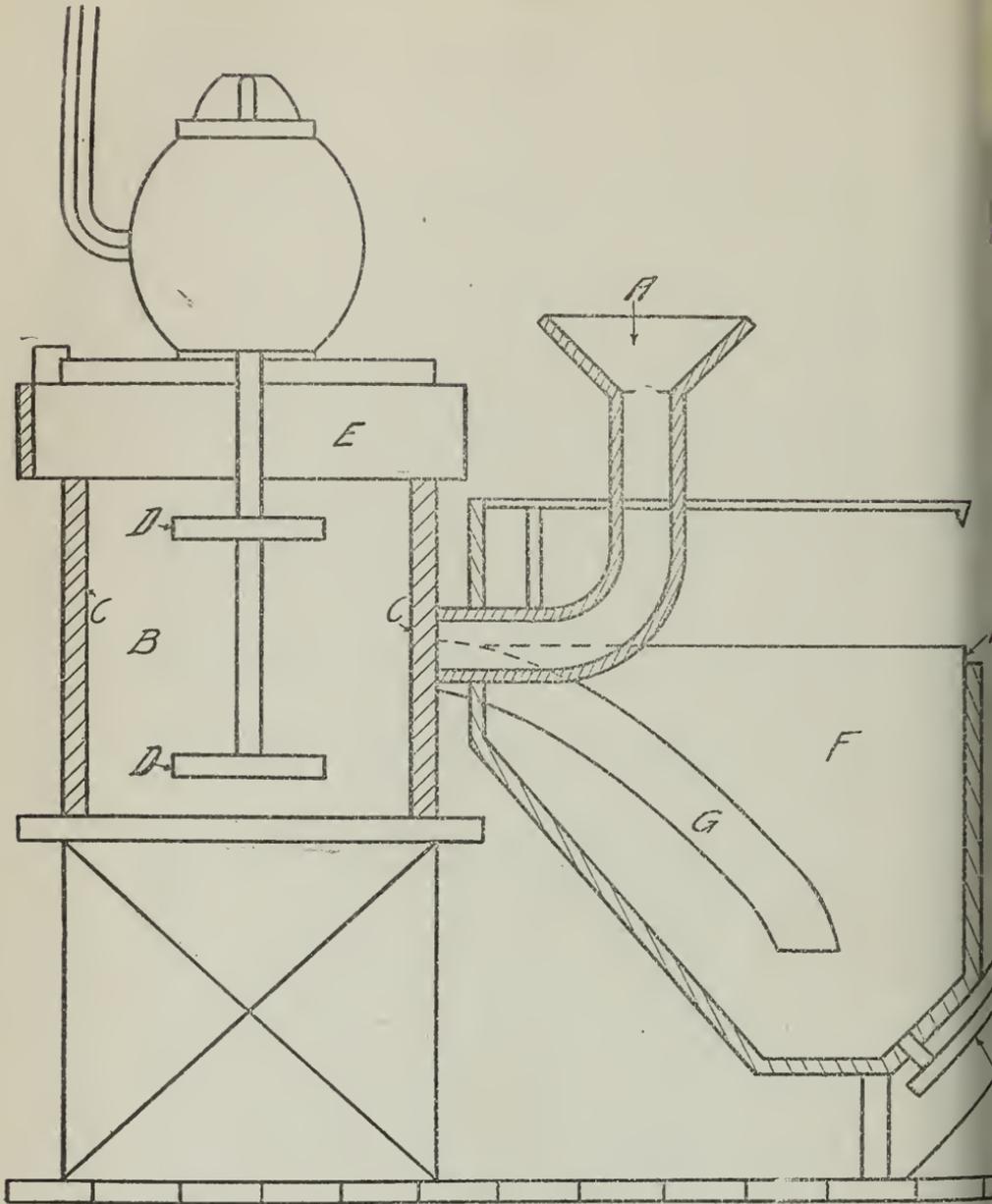
Defendant's Exhibit No. 26.

Date	FLOTATION HEADINGS			FLOT. CONCTS.			Flot. Tail's		% Indicated Recovery	Initial Oil Pounds Per Ton	Other Re-Agents Pounds Per Ton
	Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	Weight Dry Tons	Assay Percent Copper	Assay Percent Copper	Assay Percent Copper				
1914											
Dec. 8 to 31.....	2,003	105	13.19	588	42.87	.959	94.851	2.45	Nil		
1915											
1st Quarter.....	12,531	139	12.62	3,512	41.30	.776	95.648	2.87	1.30		
2d ".....	26,496	291	9.64	6,312	37.76	1.362	89.084	1.54	.292		
3d ".....	31,781	345	7.33	6,687	31.69	.850	90.812	1.48	.594		
4th ".....	24,587	267	6.47	4,713	32.29	.581	92.688	2.18	2.350		
Year 1915.....	95,395	261	9.02	21,223	35.99	.89	92.42	2.01	.900		
1916											
1st Quarter.....	26,800	298	6.17	6,601	24.14	.392	95.193	5.95	3.629		
2nd ".....	26,329	286	7.12	6,099	29.78	.391	95.766	10.97	6.191		
3d ".....	26,804	291	7.01	6,804	27.10	.306	96.717	8.76	4.570		
Oct. 1916.....	9,794	316	7.77	2,884	26.03	.20	98.17	10.26	4.768		
Nov. 18, 19, 20.....	561	187	10.24	190	29.28	.244	98.437	23.70	6.338		
Nov. 1916.....	8,444	281	7.78	2,612	23.91	.32	97.19	13.71	4.774		
Dec. 1 to 20.....	5,570	279	8.48	2,099	21.62	.412	96.989	12.39	4.398		
Dec. 21 to 31.....	2,130	194	9.24	948	20.37	.332	98.004	24.57	6.178		
Dec. 1916.....	7,800	252	8.79	3,046	21.48	.39	97.33	16.77	4.85		
4th Quarter.....	26,047	283	8.08	8,542	23.76	.292	97.585	13.33	4.798		
Year 1916.....	105,980	290	7.14	28,045	26.52	.35	96.37	10.24	4.791		
1917											
January.....	6,518	210	8.09	2,259	23.24	.29	97.63	21.10	6.458		
February.....	5,614	201	7.64	2,030	21.29	.29	97.53	21.70	6.753		
March.....	8,265	267	5.23	2,230	18.49	.39	94.54	23.73	6.348		
1st Quarter.....	20,397	227	6.81	6,519	21.01	.32	96.77	22.18	6.520		
Dec. 8, 1914 to Dec. 20, 1916.....	201,139	272	8.04	48,870	30.61	.48	95.528	5.98	4.190		
Dec. 21, 1916 to Mar. 31, 1917.....	22,536	223	7.04	7,467	20.93	.32	96.936	23.38	6.349		
All Operations up to Mar. 31, 1917.....	223,775	266	7.97	56,375	29.62	.632	94.078	9.219	2.053		
Hurley 4/2/17											

(Signed) F. R. WICKS
Asst. Supt. of Mills.

Copied Butte 4/15/17

Defendant's Exhibit No. 27.





P. 4988, insert on drawing marked "Defendant's Exhibit No. 27," the following: "Tube I regulates liquid level and should extend up to liquid level."

Defendant's Exhibit No. 28.

Record of Flotation Operations On the Treatment of Slime Vanner Tailings

Date	FLOTATION HEADINGS			FLO. CONCTS.			Flotation Tails		Initial Oil Pounds Per Ton	Other Reagents Pounds Per Ton	Oil In Circu'g Load Lbs. Per Ton	Total Oil Pounds Per Ton	Kind of Oil Used
	Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	Weight Dry Tons	Assay Percent Copper	Assay Percent Copper	% Indicated Recovery						
1915													
Apr. 16-30	8600	410	.96	157	12.78	.74	24.33	.85					
May 1-25	27750	1110	.93	495	11.14	.73	23.01	1.08					
June	None												
July 13-23	8065	733	.74	434	4.90	.54	30.37	1.45					
3d Quarter	90104	979	.72	1355	16.93	.47	35.35	1.20					
4th "	299522	3256	.78	20842	23.08	.54	35.72	1.02					
Year 1915	434041	1189	.798	23283	22.060	.540	33.14	1.04					
1st Quarter	288320	3168	.88	3915	21.27	.67	25.92	1.04					
2d "	280424	3048	.79	2846	27.03	.54	33.43	1.45					
3d "	328120	3566	.86	3516	28.07	.53	35.94	1.33					
4th "	352810	3835	.82	3668	29.53	.52	37.59	.96					
Year 1916	1249674	3414	.84	13945	26.48	.56	33.27	1.19					
Jan. 1917	127350	4108	.75	1204	31.89	.45	40.49	1.10					
Feb. 1917	124900	4461	.78	1177	28.78	.51	35.23	.53					
Mar. 1917	136170	4393	.71	1453	25.22	.44	37.89	1.46					
1st Quarter	388420	4269	.75	3834	28.63	.47	37.87	1.03					
Aver. of All Operations to Date	2072135	2999	.814	41062	24.175	.539	34.553	1.13					
1917													
Jan. 7	2058		.98		22.47	.78	24.07	9.72		*2.43	12.15		Jones Stove
Mar. 13	205		.67		9.10	.53	25.50	24.19					Coal Tar
Mar. 14	122		.80		27.60	.48	41.00	22.80					& Stove
Mar. 21	135		.69		25.10	.44	37.00	37.79					Taft
Mar. 27	2300		.63		11.73	.41	36.20	32.27					Sulphur
Apr. 2	1700		.61		14.87	.43	30.40	10.54					
Apr. 2	1965		.65		14.87	.48	27.00	.34					
Apr. 4	3250		.57		25.73	.40	30.30	8.10		3.2	11.3		

*Approximate quantity.
(Signed) O. WISER
Metallurgical Engineer.

Hurley 4/10/17
Copied Butte 4/15/17

Defendant's Exhibit No. 29.

CHINO COPPER COMPANY
HURLEY PLANT

Record of Flotation Operations On the Retreatment of Vanner Concentrates

DATE	FLOTATION HEADINGS			FLOTATION CONCTS.		FLO. TAILS		% Indicated Recovery	Initial Oil Pounds Per Ton	Other Re-Asscits Pounds Per Ton
	Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	Weight Dry Tons	Assay Percent Copper	Assay Percent Copper	Oil Pounds Per Ton			
1914										
Dec. 8 to 31.....	2,003	105	13.19	588	42.87	.959		94.851	2.45	Nil
1915										
1st Quarter.....	12,531	139	12.62	3,512	41.30	.776		95.648	2.87	.130
2nd Quarter.....	26,496	291	9.64	6,312	37.76	1.362		89.084	1.54	.292
3rd Quarter.....	31,781	345	7.33	6,687	31.69	.850		90.812	1.48	.594
4th Quarter.....	24,587	267	6.47	4,713	32.29	.581		92.688	2.18	2.350
Year 1915.....	95,395	261	9.02	21,223	35.99	.89		92.42	2.01	.900
1916										
1st Quarter.....	26,800	298	6.17	6,601	24.14	.392		95.193	5.95	3.629
2nd Quarter.....	26,329	285	7.12	6,099	29.78	.391		95.766	10.97	6.191
3rd Quarter.....	26,804	291	7.01	6,804	27.10	.306		96.717	8.76	4.570
Oct. 1916.....	9,794	316	7.77	2,884	26.03	.20		98.17	10.26	4.768
Nov. 18, 19, 20.....	561	187	10.24	190	29.28	.244		98.437	23.70	6.338
Nov. 1916.....	8,444	281	7.78	2,612	23.91	.32		97.19	13.71	4.774
Dec. 1 to 20.....	5,570	279	8.48	2,099	21.62	.412		96.989	12.39	4.398
Dec. 21 to 31.....	2,139	194	9.24	948	20.37	.332		98.004	24.57	6.178
Dec. 1916.....	7,809	252	8.79	3,046	21.48	.39		97.33	16.77	4.86
4th Quarter.....	26,047	283	8.08	8,542	23.76	.292		97.585	13.33	4.798
Year 1916.....	105,980	290	7.14	28,045	26.52	.35		96.37	10.24	4.791
1917										
January.....	6,518	210	8.09	2,259	23.24	.29		97.63	21.10	6.458
February.....	5,614	201	7.64	2,030	21.29	.29		97.53	21.70	6.753
March.....	8,265	267	5.23	2,230	18.49	.39		94.54	23.73	6.348
1st Quarter.....	20,397	227	6.81	6,519	21.01	.32		96.77	22.18	6.520
Dec. 8, 1914 to Dec. 20, 1916.....	201,139	272	8.04	48,876	30.61	.48		95.528	5.98	4.190
Dec. 21, 1916 to Mar. 31, 1917.....	22,536	223	7.04	7,467	20.93	.32		96.936	23.38	6.349
All operations up to Mar. 31, 1917.....	223,775	266	7.97	56,375	29.62	.632		94.078	9.219	2.053

(Signed) F. R. WICKS
Asst. Sup. of Gen.

UTAH COPPER COMPANY
Flotation Retreatment Plant Results
February 1, 1915 to February 28, 1917

Month	Estimated Tons Treated	HEADING				Tailing
		Cu.	Fe.	Insol.		
1915						
Feb.	10,204	9.320	6.97	72.44	.370	
March	12,016	8.087	7.21	72.13	.419	
April	14,150	7.200	7.48	73.16	.260	
May	16,252	8.850	7.34	71.38	.250	
June	16,847	7.380	7.06	72.78	.330	
July	17,716	8.650	7.76	69.93	.570	
August	17,664	10.050	7.38	69.10	.560	
Sept.	16,605	8.914	8.49	67.33	.549	
October	16,547	9.162	6.68	71.82	.300	
November	16,405	8.831	8.22	68.99	.219	
December	15,719	8.487	6.90	72.54	.409	
1916						
January	14,213	8.114	5.60	74.79	.259	
February	13,403	7.053	5.43	76.61	.301	
March	15,799	6.041	5.03	79.65	.316	
April	17,331	6.034	5.02	78.23	.354	
May	20,334	7.107	6.18	75.14	.365	
June	24,759	6.811	6.83	73.28	.381	
July	26,024	6.899	6.03	75.79	.471	
August	27,436	7.104	7.26	73.29	.357	
Sept.	27,183	7.219	6.57	74.38	.338	
October	25,918	7.150	6.21	74.54	.275	
November	23,685	6.751	6.73	73.96	.284	
Dec. 1 to 21, incl.....	14,076	6.749	5.99	75.12	.380	
Total	420,285					1.999
Average		7.625	6.70	73.43	.361	

USING 20 POUNDS OF

Month	Tons Treated	HEADING				Tailing	Tons Copper Produced
		Cu.	Fe.	Insol.			
1917							
Dec. 22 to 31, incl.....	2,321	4.908	3.98	81.82	.199	43	
January	17,905	5.288	5.14	78.77	.172	385	
February	17,962	5.806	5.81	76.59	.223	445	
March	19,937	5.189	6.04	77.22	.228	486	
April 1-8	5,051	4.928	6.89	76.39	*.586	122	
Total	63,176					1483	
Average		5.361	5.71	77.58	.238		

* The high tailing obtained from April 1st to 8th, 1917, inclusive, was due to one machine in operation February 1st, 1915 to July 11th, 1916, inclusive. Two machines in operation July 12th, 1916 to April 8th, 1917, inclusive.

Arthur, Utah.

April 21, 1917.

Copied Aug. 13th, 1917.

Butte, Mont.--MCD

Filed May 18 1917

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Exhibit No. 30.

A Y—ARTHUR PLANT

Treating Mineral Classifier Overflow

April 8, 1917—Inclusive

No.	CONCENTRATE			% Ind. Ext'n	Ratio Conct.	POUNDS PER TON		Per Cent Solids
	Cu.	Fe.	Insol.			Oil	Reagents	
30.760	19.78	16.46	97.20	3.40	2.27	4.68	42.30	
27.248	22.04	16.00	96.30	3.50	1.54	5.85	41.29	
25.890	23.79	16.02	97.37	3.69	1.64	9.51	38.44	
28.920	21.13	15.82	98.02	3.33	1.83	2.83	37.95	
28.230	20.32	18.22	96.66	3.96	1.90	2.34	40.56	
25.580	20.70	19.65	95.54	3.10	2.88	1.98	28.80	
29.070	18.67	19.37	96.28	3.00	2.48	2.43	26.85	
25.032	20.71	19.91	95.94	2.93	3.19	2.07	28.14	
30.571	19.67	16.29	97.69	3.42	8.94	1.89	23.09	
28.186	21.33	15.75	98.28	3.25	4.25	2.39	25.89	
28.775	20.40	16.19	96.55	3.51	3.50	2.94	24.94	
32.025	19.12	15.33	97.60	4.04	4.34	2.03	20.37	
30.190	20.69	14.45	96.69	4.43	4.26	2.64	19.41	
28.304	22.08	14.55	95.84	4.89	3.61	2.32	25.24	
26.746	21.60	16.77	95.40	4.65	3.21	2.95	24.59	
26.254	21.88	17.48	96.20	3.84	2.66	3.98	24.63	
23.285	23.07	18.25	95.97	3.56	2.71	3.65	25.45	
23.828	20.88	21.98	95.05	3.63	3.67	4.51	22.68	
24.305	22.50	18.25	96.39	3.55	4.42	5.25	23.87	
25.615	22.71	16.62	96.59	3.67	4.84	5.27	29.15	
27.030	22.53	15.32	97.14	3.89	5.00	7.25	32.86	
25.173	24.24	15.18	96.89	3.85	5.52	7.09	31.52	
25.355	22.90	19.16	95.80	3.92	5.21	7.21	27.44	
26.800	21.53	17.34	96.57	3.64	3.76	4.05	28.43	

PER TON OF ORE TREATED

No.	CONCENTRATE			% Ind. Ext'n	Ratio Conct.	POUNDS PER TON			Per Cent Solids
	Fe.	Insol.	Reagents			OILS			
						New	Circ.	Total	
2713	19.38	21.75	96.69	5.36	23.95		23.95	9.90	26.00
2153	21.58	18.85	97.44	4.64	19.73	1.02	20.75	5.04	28.94
2733	20.76	22.58	97.11	4.03	15.39	2.91	18.30	5.51	29.09
2712	22.09	21.70	96.67	4.10	15.33	4.93	20.26	6.35	30.71
1546	21.99	22.36	90.98	4.14	39.13	6.26	45.39	7.40	29.13
2180	21.47	21.28	96.60	4.28	18.81	3.17	21.98	5.96	29.45

sie experimenting with oils.

Defendant's Exhibit

UTAH COPPER COMPANY—A
EXPERIMENTAL AND RESEARCH

Summary of Results Obtained from Commercial Experiments

Exp. No.	Hours Duration	HEADING				TAILING		CONCENTRATE				Ratio Conct.	% Ind. Ext's	% Solids in Feed	Tons Circ. Feed
		Dry Tons	% Cu.	% Fe.	% Insol.	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	Insol.				
USING 59% SMELTER FUEL, 30% JONES, 10% AMERICAN CREOSOTE NO															
1	8	151	4.500	7.40	76.20	124.7	1.577	26.3	18.325	28.10	11.90	5.73	71.07	30.35	23
2	24	638	4.700	6.53	77.20	502.3	1.066	135.7	18.158	25.75	16.28	4.70	82.14	30.94	82
3	24	594	4.216	6.60	75.93	452.2	.456	141.8	16.209	25.33	17.78	4.19	92.43	28.69	102
4	24	697	5.433	6.03	75.80	523.3	.324	173.7	20.818	22.87	20.14	4.01	95.52	30.25	114
5	24	652	4.700	6.97	76.53	490.7	.226	161.3	18.321	25.81	16.51	4.04	96.38	28.40	110
6	24	627	4.733	6.87	76.20	471.8	.141	155.2	18.692	24.50	18.77	4.04	97.76	27.65	89
7	24	597	3.833	6.27	79.00	478.1	.076	118.9	18.950	23.69	19.39	5.02	98.41	26.43	75
8	16	278	4.00	5.65	80.20	213.2	.251	64.8	16.325	24.95	17.40	4.29	95.19	17.45	51
9	24	731	4.166	7.10	74.40	553.1	.119	177.9	16.764	22.26	23.20	4.11	97.84	33.11	106
10	16	438	3.900	6.95	75.60	323.3	.100	114.7	14.600	24.93	21.83	3.82	98.11	26.83	58
11	24	572	4.500	7.30	75.47	425.7	.166	146.3	17.099	22.14	22.24	3.91	97.26	27.24	74
12	24	693	5.933	6.80	75.00	473.7	.268	219.3	18.169	18.87	27.62	3.16	96.91	29.94	92
13	24	643	5.300	7.53	76.53	452.8	.272	190.2	17.250	19.61	25.76	3.38	96.39	31.23	123
USING 91% AMERICAN CREOSOTE NO															
14	2	53	4.500	7.50	77.60	49.0	3.433	4.0	17.400	25.80	16.20	13.09	29.54	27.04	6
15	8	218	5.100	6.40	77.20	186.5	2.460	31.5	20.700	26.15	14.00	6.91	58.75	30.18	46
16	8	244	5.600	7.40	75.80	185.6	.740	58.4	21.050	27.30	10.40	4.18	89.95	31.09	32
17	8	181	4.500	8.00	76.20	143.5	.810	37.5	18.650	27.87	12.20	4.83	85.72	23.64	21
18	4	120	5.500	6.20	76.60	106.5	3.502	13.5	21.250	25.85	16.25	8.88	43.49	30.15	16
19	4	147	5.950	5.50	76.80	114.8	1.217	32.2	22.850	24.40	16.00	4.57	84.02	28.57	22
USING 60% SMELTER FUEL AMERICAN CREOSOTE NO															
20	24	628	4.716	5.86	78.46	478.5	.306	149.5	18.812	19.69	26.13	4.20	95.06	26.70	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

No. 31.

ARTHUR PLANT
CASH DEPARTMENT

Experiments on Low Grade Concentrate

	POUNDS NEW OIL ADDED			CIRCULATING OIL			TOTAL NEW AND CIRCULATING OIL			FLOW CELLS		REAGENTS		
	Tons Total Feed	Total Pounds	Per Ton New Feed	Per Ton Total Feed	Total Lbs.	Per Ton New Feed	Per Ton Total Feed	Total Pounds	Per Ton New Feed	Per Ton Total Feed	To Bins	To Circ.	Total Pounds	Pounds Per Ton
AN CREOSOTE NO. 2, 1% YARYAN PINE														
174	242	1.60	1.39	953	6.31	5.48	1195	7.91	6.87	7	21	1532	10.14	
720	2394	3.75	3.33	3951	6.19	5.49	6345	9.94	8.82	6	22	5796	9.08	
696	4419	7.44	6.35	3869	6.51	5.56	8288	13.95	11.91	7	21	4288	7.22	
811	6863	9.85	8.46	4920	7.06	6.07	11783	16.91	14.53	9	19	4824	6.92	
762	8031	12.32	10.54	4579	7.02	6.01	12610	19.34	16.55	7	21	3752	5.75	
716	9418	15.02	13.15	5596	8.93	7.82	15014	23.95	20.97	7	21	3752	5.98	
672	12133	20.33	18.06	5000	8.37	7.44	17133	28.70	25.50	6	22	3216	5.39	
329	9210	33.13	27.99	2514	9.04	7.64	11724	42.17	35.63	7	21	3828	13.77	
837	26614	36.41	31.80	3896	5.33	4.65	30510	41.74	36.45	12	16	6331	11.07	
496	15514	35.42	31.28	2694	6.15	5.43	18208	41.57	36.71	8	20	4829	11.03	
646	34060	59.55	52.72	4311	7.53	6.67	38371	67.08	59.39	10	18	6331	11.07	
785	45008	64.95	57.33	5172	7.46	6.59	50180	72.41	63.92	14	14	3885	5.61	
766	66512	103.44	86.83	7375	11.47	9.63	73887	114.91	96.46	12	16	6364	9.90	
NO. 2 AND 9% YARYAN PINE														
59	36	.68	.61							1	9	368	6.94	
264	213	.98	.81							3	9	1398	6.41	
276	364	1.49	1.32							4	7	1205	4.94	
202	356	1.97	1.76							5	11	1282	7.08	
136	129	1.08	.95	151	1.25	1.11	280	2.33	2.06	6	8	636	5.30	
169	261	1.78	1.54	343	2.33	2.03	604	4.11	3.57	8	8	777	5.29	
NO. 2 AND 40% JONES OIL														
	11206	17.84									28		3885	6.19

Refer to
Exp. ↘

Defendant's Exhibit No. 32.

UTAH COPPER COMPANY—ARTHUR PLANT
EXPERIMENTAL AND RESEARCH DEPARTMENT

Summary of Returns Obtained from Commercial Experiments On Slime Feed

Exp. No.	Hours Duration	HEADING		TAILING							CONCENTRATE							POUNDS PER TON	
		Dry Tons	% Cu.	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	% Insol.	Ind. Ext'n	Ratio Conct.	Oil	Acid	Oil	Acid				
USING		98 PERCENT	{	60 Per Cent	34°	Paraffine Base	Distillate	{	2 Per Cent	{	95 Per Cent	Barrett No. 4	Creosote	{	5 Per Cent	Yaryan Pine			
21	8	284.0	1.430	180	15.8	22,600	14.50	34.20	88.11	17.94	10.15	7.42							
22	8	238.0	1.045	230.1	4.75	17,700	13,800	38.00	56.05	30.22	11.36	7.44							
23	8	252.0	1.485	234.4	3.10	17,100	12,80	39.60	80.59	14.29	15.32	6.67							
24	8	230.0	970	221.3	1.80	21,000	16.50	29.00	82.15	26.35	20.19	8.46							
25	24	611.0	1,030	576.1	1.80	34.9	15,433	14.66	40.00	83.83	20.69	8.11							
26	8	174.0	980	166.3	1.70	7.7	18,500	18.10	31.20	83.42	39.26	17.33							
27	8	260.0	700	250.8	1.10	9.4	16,400	12.70	42.00	84.85	56.93	6.46							
28	4	137.5	940	129.4	1.00	8.1	14,300	8.90	50.90	89.99	16.90	7.40							
29	4	137.5	1,060	128.7	1.10	8.8	15,000	12.40	44.00	90.28	15.67	99.43							
USING		{	95 Per Cent	Barrett No. 4	Creosote	{	5 Per Cent	Yaryan Pine											
30	16	526.0	1,085	516.9	9.95	9.1	6,200	6.30	69.70	9.88	57.83	.48	5.62	Refer to Experiment No.	25				
31	8	307.0	1,020	305.4	1.015	.6	3,450	5.00	74.60	.69	487.00	.53	6.20	"	26				
32	8	202.0	.875	194.4	.760	7.6	3,800	5.40	74.40	16.46	26.43	.95	10.43	"	27				
33	8	205.0	790	204.9	.780	.1	17,200	12.00	44.00	1.33	1642.00	1.57	9.26	"	28				

1,167,076.

Patented Jan. 4, 1918

3 SHEETS—SHEET 1

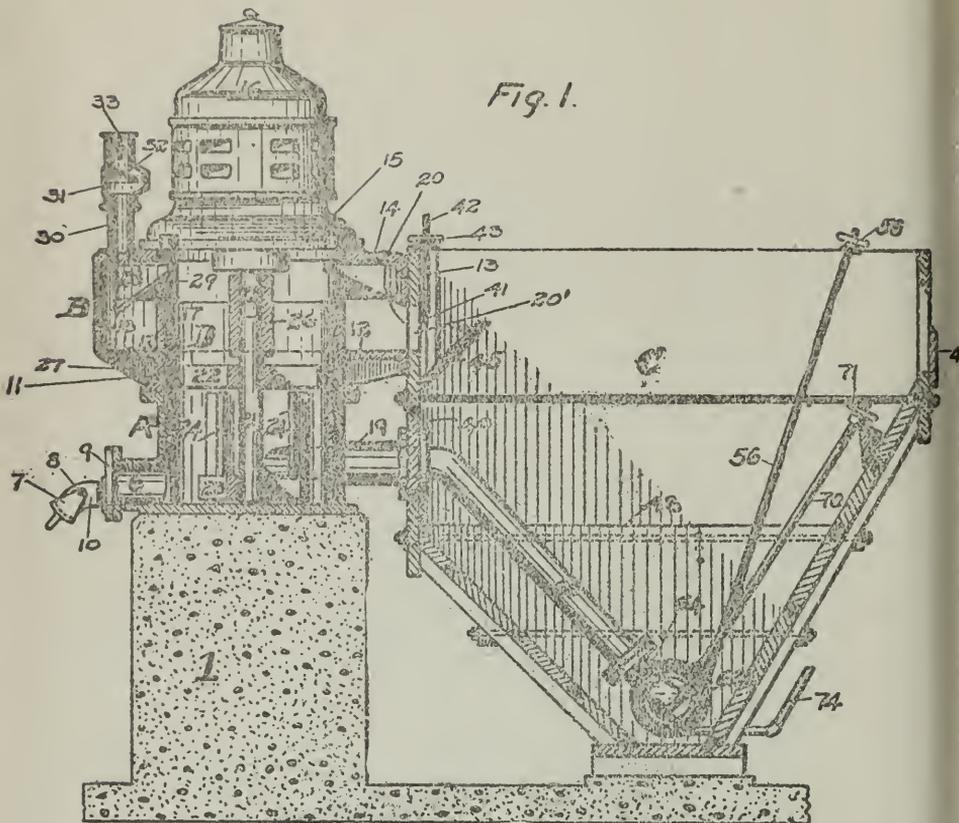


Fig. 1.

WITNESSES:

Ed Mitchell
W. H. Dornboach

INVENTOR

Thomas A. Janney
 BY
Heidan Willson & Co.
 ATTORNEY

167,076.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 2.

Fig. 2

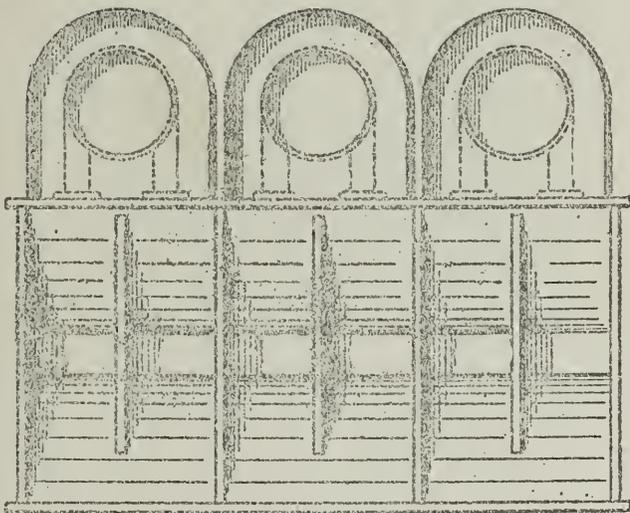
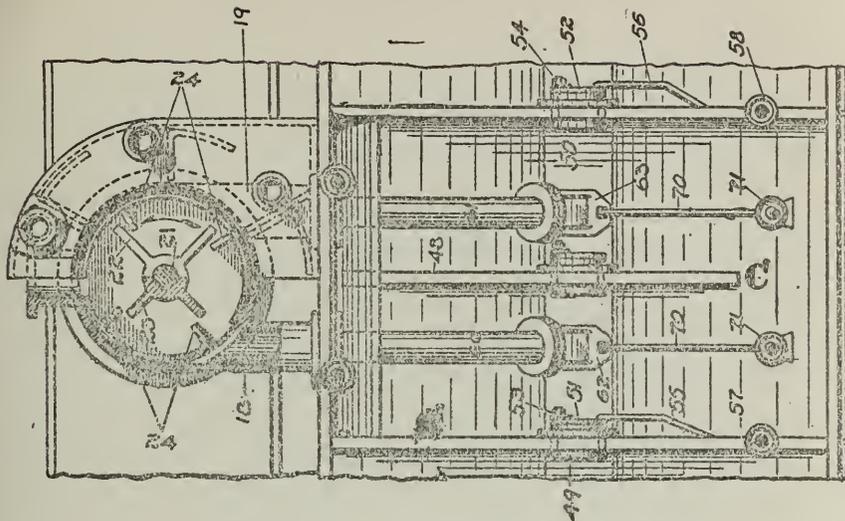


Fig. 4.

WITNESSES:

E. Mitchell

W. H. Doseubach

INVENTOR

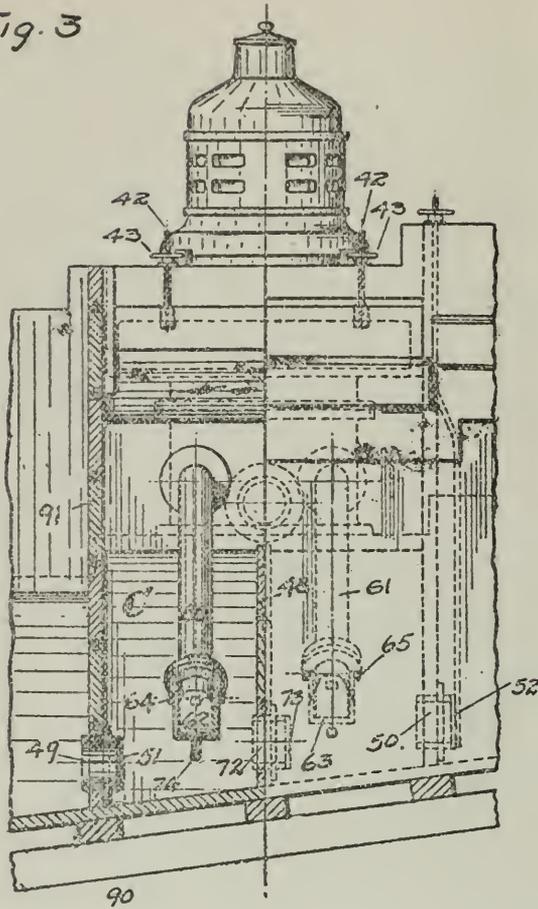
Thomas A. Janney

BY

Sheldon W. Johnson & Scott

ATTORNEYS

Fig. 3



WITNESSES:

Ed Mitchell
B. H. Dosembach.

INVENTOR

Thomas A. Janney
 BY
Meridian Wilkinson & Co.

UNITED STATES PATENT OFFICE.

THOMAS A. JANNEY, OF GARFIELD, UTAH.

ORE-CONCENTRATING APPARATUS.

1,167,076.

Specification of Letters Patent.

Patented Jan. 4, 1916.

Application filed August 10, 1914. Serial No. 856,092.

To all whom it may concern:

Be it known that I, THOMAS A. JANNEY, citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore-Concentrating Apparatus, of which the following is a specification.

The object of my invention is to provide an improved apparatus for carrying out flotation processes of concentrating ores.

The apparatus herein described and claimed is of the same general type as that set forth in my copending application, Serial No. 833,973, filed April 23, 1914, in that its operation involves repeated circulation of the ore pulp in each unit of the apparatus, but differs in the simplification of the connections between different units of the apparatus when arranged in series, thus economizing space, simplifying construction, and giving a more direct flow of the pulp from one unit of the apparatus to the next.

Another improved feature of the apparatus herein described and claimed is the use of an agitating vessel of less depth than, and arranged on a higher level than the related separating box or spitzkasten of the same unit. The shallower agitating vessel leads to a great economy in power by reason of the fact that the agitating blades are submerged under a much less head of liquid and hence impart the requisite stirring while working against a much decreased pressure, and at the same time the necessary depth of the separating box is maintained, thus giving ample opportunity for separation of the floating and sinking constituents and preventing disturbance of the floating material by the currents caused by removal of pulp from the bottom of the box.

The particular object and nature of my invention, and the scope thereof, will more fully appear from the following description, and the accompanying drawings of one form of apparatus embodying the same.

In the drawings, Figure 1 is a vertical section through the agitation vessel and the connected separating box. Fig. 2 is a plan view partly in section to more fully show the construction. Fig. 3 is an elevation of the apparatus, partly in section, from the right hand side of Fig. 1. Fig. 4 is a diagrammatic plan view of several units of the apparatus connected in series.

The apparatus rests upon a foundation 1 having an elevated pedestal to support the agitating vessel D at a higher level than the separating box C.

The agitating vessel in the particular form of the device illustrated, consists of two main castings, A and B, the former resting upon the foundation 1. In the lower casting A at the bottom of the agitation vessel, I provide a drainage spout 6 to which is fitted a valve consisting of plate 9 secured to the end of spout B, tubular extension 10, and valve member 7 pivoted at 8 and adapted to control the outlet from the bottom of the agitation vessel. In operation the drainage spout 6 is closed and is opened only for the purpose of flushing out the apparatus when shut down for repairs or otherwise.

The upper casting B of the agitation vessel comprises a lower cylindrical part 11, seated on the lower casting 4, an outwardly extending substantially horizontal part 12, from which there extends upwardly the part 13, which is closed at its upper end by the inwardly extending top flange 14 and by the base 15 of the motor casing 16. The part 13, as shown in Fig. 2, is cylindrical in form on the side away from the spitzkasten, but rectangular on the side adjoining and communicating with the spitzkasten. A cylindrical lining 17 extends from the bottom of the main chamber of the agitation vessel to a point considerably above the outward projection 12 of the upper casting B, the lining being apertured opposite the spout 6, and opposite the ducts 18, 19 which form part of the lower casting and communicate with the separating box C.

The enlarged part 13 of the upper part of the agitation vessel is provided on the side thereof adjacent the separating box with an outlet opening 20 through which the pulp after being agitated and thrown upwardly over the upper edge of the lining 17, may flow to the separating box C.

The shaft 25 of an electric motor within the casing 16 is detachably connected to the agitator shaft 21 by a coupling 26, and two agitators 22 and 23, each consisting of four radial arms, are secured to the shaft 21. Projecting inwardly from the lining 17 of the agitation vessel D, are ribs or baffles 24, the arms of the lower agitator 23 being shorter than those of the upper agitator 22 in order to just clear the baffles and just

clear the inner surface of the lining 17. The upper casting B of the agitation vessel D is strengthened by braces 27 and 28 which are cast integral therewith. Liner plates 29, are bolted or otherwise secured to the braces 28 on the side thereof against which the pulp is thrown by the agitator. In the present instance the agitator is designed to revolve in the direction indicated by the arrow in Fig. 2. The braces 28 and liner plates 29, perform the additional function of preventing the pulp, which is thrown upwardly and outwardly by the agitator, from escaping through the air inlet pipes 30, which extend upwardly from openings in the top 14 of the agitation vessel, the upwardly extending pipes themselves forming an additional safeguard against escape of pulp. Upon the upper ends of the pipes 30 are valve casings 31, provided with valves 33 to regulate the admission of air, and with deflector plates 32 extending across the axes of the casings 31 to arrest any pulp that might be thrown upwardly in the pipes 30. The circular movement of the pulp as it is thrown upwardly is arrested by the plates 29, thus causing the pulp to fall into the launder formed outside of the liner 17 by the upper part of the liner, the outwardly extending floor 12 and the vertical wall 13.

The spitz box or separating box C is placed opposite and adjacent the agitation vessel D and is of the usual tapering form at its lower end. The side 40 of the separating box adjoining the agitation vessel is provided with an opening 20', registering with the opening 20 in the enlarged part 13 of the agitation vessel, and a sliding valve or gate 41 is provided for regulating the opening 20—20'. The gate 41 is suspended on screw-threaded rods 42 in engagement with screw-threaded adjusting wheels 43 which rest upon supports at the upper edge of the wall of the box.

Extending upwardly and outwardly from a point below the opening 20—20' I provide a guide plate 45 designed to give an upward direction to the pulp issuing from the opening 20—20'.

The box C is provided with an adjustable overflow gate 46. Extending upwardly from the bottom of the separating box C is a partition or baffle 48, the upper edge of the same being located about midway between the bottom of the box and the water level therein as determined by the overflow gate 46.

Pulp enters and leaves the apparatus through inlet and outlet openings 50 and 49, in the sides of the separating box, but is prevented by the baffle 48 from passing through the separating box without traversing the agitation vessel. Extending from the lower part of the separating box are two circulation pipes or ducts 60, 61, one on each side of

the baffle 48. These pipes 60, 61 extend upwardly to the side of the box next the agitation vessel, where they communicate through ports in the side of the box, with the ducts 18, 19, extending outwardly from the lower part of the agitation vessel. The openings in the lower ends of the pipes 60, 61, are controlled by valves 62, 63, which have arms pivoted to said pipes as indicated at 64 and 65 and have an arcuate movement across the ends thereof. The valves 62, 63, are provided with operating rods 70, and are adjusted by hand wheels 71 screw-threaded thereon. The inlet and outlet openings 50 and 49, are regulated by valves 51, 52, which are operated by hand wheels 57, 58, screw-threaded on operating rods 55, 56. The baffle 48, is provided with an opening 72 at the lower part of the separating box, which opening is normally closed by a valve 73, when the apparatus is in operation, the valve 73 being opened only when one unit of a series is to be put out of operation without disturbing the operation of the other members or units of the series.

Water supply pipes 74, having their ends directed into the ends of the pipes 60 and 61, are provided for the purpose of flushing the apparatus in case it gets clogged through settlement of the pulp.

In operation the apparatus may be used either in single units or in series as diagrammatically illustrated in Fig. 4. In operation the apparatus is first started or primed with water, ore pulp not being admitted until after the apparatus is started with water. In this way all liability is avoided of clogging the apparatus by settlement of the ore, which might occur if pulp were admitted before a current was established through the apparatus. In starting a single unit of the apparatus, the outlet valve 49 of the separating box is closed and the inlet and circulation valves opened. As soon as the apparatus fills with water to a height sufficient to submerge the lower agitator 23, the agitator commences to agitate and force the water upward in the agitation vessel D, and to throw it through the opening at the top thereof, whence it flows through the duct 20—20' to the separating box C. A higher effective level or hydraulic head is thus established in the separating box and the water begins to flow back to the agitation vessel D through the ducts 60, 61, thus establishing the local circulation. Thereupon the outlet 49 is opened, and pulp instead of water is admitted through the inlet 50. If several units are to be operated in series as diagrammatically illustrated in Fig. 4, the several units are preferably arranged upon an incline, the pulp entering the highest unit and discharging from the lowest. In Fig. 3 I have shown the bottom of the separating box inclining downward from the inlet to

discharge side, and this inclination is continuous in a series of machines, the bottom 90 extending under all of the separating boxes at the same inclination and the different boxes being separated from each other by vertical walls 91. The extent of local circulation imparted to the pulp in each part of the apparatus may be regulated through adjustment of the valves and speed of the agitators, the circulation being brought about by the fact that pulp is discharged upward from the agitation vessels in the spitz box at a more rapid rate than is supplied to and discharge from the apparatus through the inlet 50 and outlet 49. Baffles or partitions 48 prevent the heavy coarse material or any part of the pulp from passing directly through the separating box without entering the agitation vessel and thus insure circulation. I provide an opening 72 in the baffle or partition 48, and this opening is closed in the operation of the apparatus by a valve 73. In case however it is necessary to stop the operation of one unit of a series for repairs or other purpose, this may be done without interrupting the operation of the other members of the series, it being necessary merely to open the valve 73 in the partition or baffle, thus permitting the pulp to flow directly through the separating box C of the disabled unit, without traversing the agitation vessel thereof.

In operation it may be found advantageous to adjust the gate 41 controlling the duct 20-20' leading to the separating box from the agitation vessel with the lower edge of the gate beneath the liquid level. In this event air cannot flow into the agitation vessel through the port 20-20', and I have therefore provided the air pipes 30 as before described, and the air valves 31 whereby the amount of air admitted to the agitation vessel may be controlled for the purpose of governing the character of froth produced.

That I claim is:

In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided respectively with admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, and means for moving an ore pulp upwardly in said vessel and said box.

In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided respectively with admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, said separating box

having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

3. In a device of the class described, an agitation vessel, a separating box having admission and discharge chambers provided with valved admission and discharge ports respectively, admission chamber and discharge chamber circulation ports connecting said chambers respectively with the lower part of said agitation vessel, valves in said ports, said separating box having an overflow lip, a duct connecting said vessel and box at a point above said overflow lip, and means for impelling an ore pulp upwardly in said vessel.

4. In a device of the class described, an agitation vessel, a separating box adjacent said vessel and communicating therewith through two ducts adjacent the bottom thereof, a baffle extending upward from the bottom of said box between said ducts to a point above the same, admission and discharge ports communicating with said box on opposite sides of said baffle, and means for moving an ore pulp upwardly in said vessel and into said box.

5. In an apparatus of the class described, a series of separating boxes and agitation vessels, each of said separating boxes having communication adjacent its lower end with an adjoining agitation vessel, and each box having communication adjacent its lower end with the next succeeding box, a duct extending from each agitation vessel above the liquid level in the adjoining separating box and opening into said box, means for forcing an ore pulp upwardly in said agitation vessels, and means for compelling pulp entering each box to pass through the adjoining vessel before passing to the next box.

6. In a device of the class described, an agitation vessel, a separating box extending to a lower level than said vessel, an upper duct connecting said vessel and box at a point higher than the liquid level therein, and a lower duct connecting the same beneath the liquid level, and means in said vessel for agitating an ore pulp and impelling the same upward through said duct.

7. In a device of the class described, a separating box provided with an overflow, an agitating vessel of less depth than said box and opposite the upper part thereof, said vessel having an opening above said overflow and leading to said box, said vessel and box being also connected by a duct leading from the lower part of said box, and means in said vessel for agitating an ore pulp and impelling same upwardly.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting said boxes at a point adjacent the bottoms

thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom of said boxes to prevent direct flow of pulp therethrough.

5 9. In a device of the class described, a series of units each comprising an agitation vessel and separating box, ducts connecting
10 said boxes at a point adjacent the bottoms thereof and ducts leading from the lower part of said boxes to said vessels and partitions extending upwardly from the bottom
15 of said boxes to prevent direct flow of pulp therethrough, said partitions having orifices and valves controlling said orifices.

10. In a device of the class described, an agitation vessel and separating box communicating with each other by a duct extending above the liquid level in said box and opening into said box substantially at the liquid level, a substantially air-tight cover over said box, said cover having air inlet openings and means for controlling the inflow of air through said openings.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:

R. H. HAWLEY,
WALTER A. SCOTT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patent Washington, D. C."

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

ORE CONCENTRATING APPARATUS.

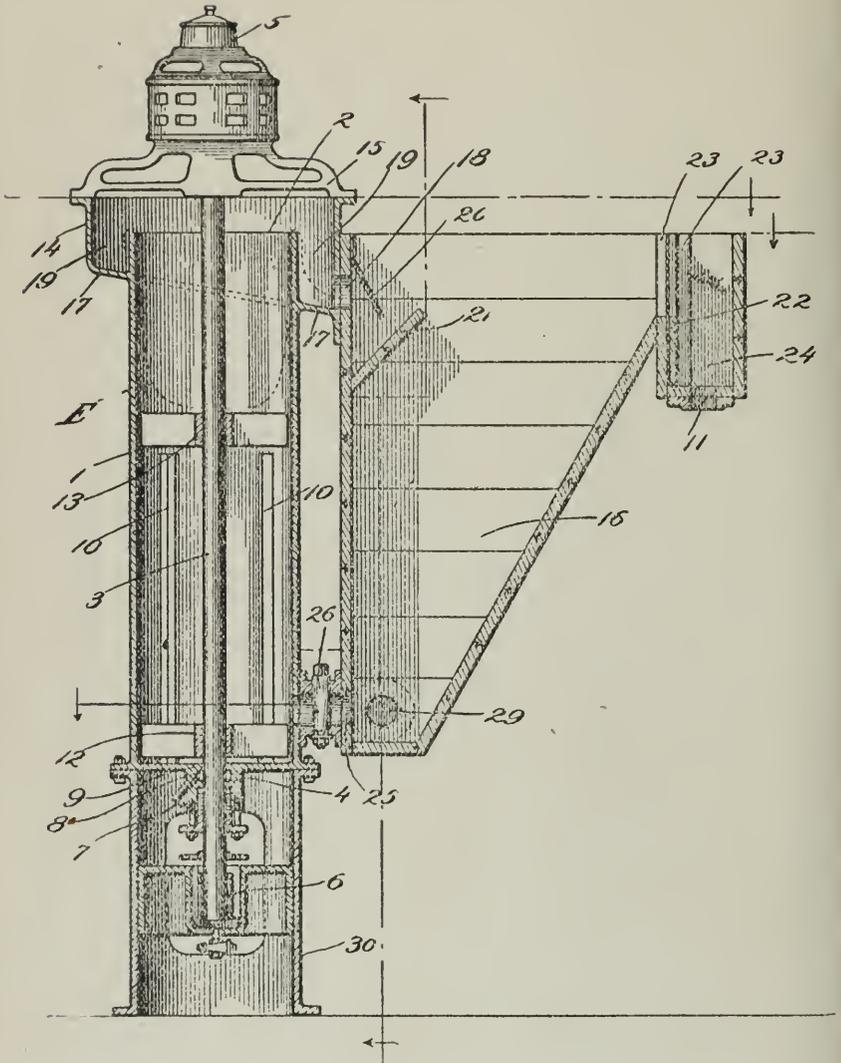
APPLICATION FILED APR. 23, 1914.

1,201,053.

Patented Oct. 10, 1916

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

C. Burnap

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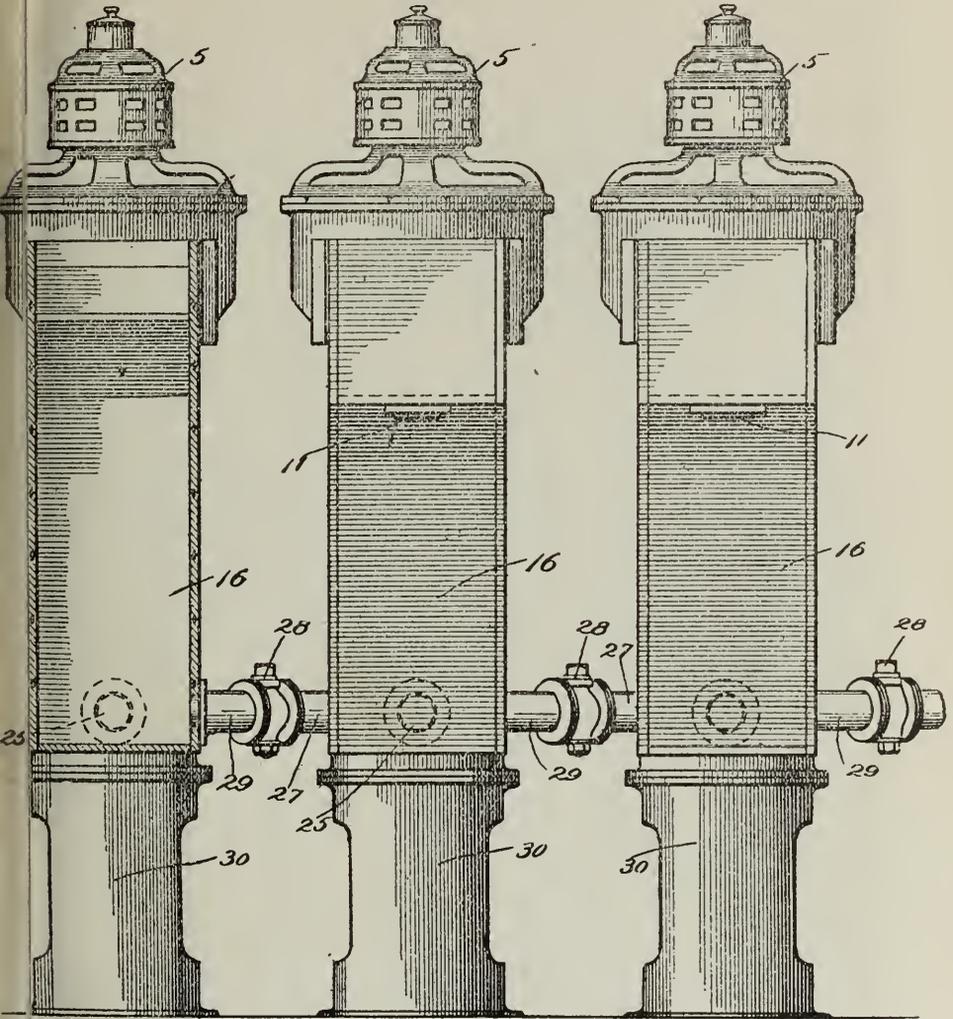
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1201,053.

Fig. 2.



Witnesses:

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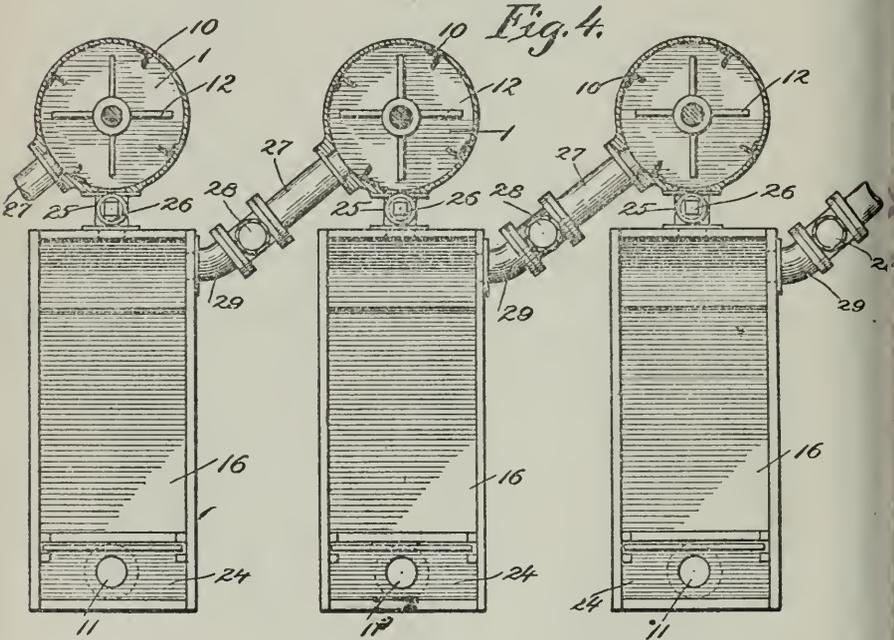
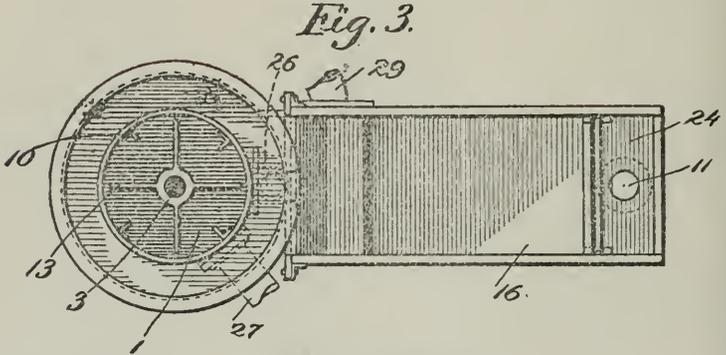
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ORE CONCENTRATING APPARATUS.
APPLICATION FILED APR. 23, 1914.

1,201,053.

Patented Oct. 10, 1916.
3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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ORE-CONCENTRATING APPARATUS.

201,053.

Specification of Letters Patent.

Patented Oct. 10, 1916.

Application filed April 23, 1914. Serial No. 833,973.

Call whom it may concern:

Be it known that I, THOMAS A. JANNEY, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Ore-Concentrating Apparatus of which the following is a specification.

My invention has for its object the improvement of apparatus used in the concentration of ores by the oil flotation process, in which process the ore mixed with water in the form of a freely flowing pulp is agitated with oil and other reagents, if such a necessary or beneficial, with the result that the metalliferous part of the ore is caused to float when the pulp is removed from the zone of agitation and permitted to assume a condition of substantial quiescence. This process can be carried out in many different forms of apparatus, but the apparatus forming the subject-matter of my invention possesses several distinct and novel advantages, among which are the facts that the apparatus, embodying a series of agitating chambers or mixers and separation boxes, or spitz-boxes, may all be arranged upon the same level, the energy used for agitating the pulp serving in conjunction with gravity the purpose of moving the pulp through the series of agitation chambers and spitz-boxes. In my improved apparatus the mixture may also be subjected to successive periods of agitation and flotation in each unit of the series, this being effected by moving the mixture through as many cycles as desired in each unit before it passes to the next unit of the series. Another advantage arises from the fact that when a single agitating chamber and separating box are used for treating a single charge, the pulp may be permitted to circulate for an indefinite period of time through said chamber and box without particular attention, the floating concentrate being allowed to accumulate in the separating box from which it may be removed intermittently by mechanical means or overflow, being removed by overflow continuously formed, such overflow being effected by a suitably regulated supply of water or pulp. Other advantages in simplicity of structure of the apparatus, durability and simplicity

of operation will appear from the following description and drawings, in which—

Figure 1 is a vertical sectional view through an agitating chamber and separating box. Fig. 2 is an elevation partly in section of several units connected in series, each unit consisting of an agitating chamber and separating box, the section being through the separating box of the first unit. Fig. 3 is a plan view of the structure shown in Fig. 1; and Fig. 4 is a fragmentary plan view of the structure shown in Fig. 2, the agitating vessels being in section upon a plane between the lower and upper agitators.

I will describe the mechanical construction of the apparatus principally with reference to Figs. 1 and 3 for the reason that those figures being in section best illustrate the interior construction. While in my description I refer to the specific form and arrangement of various parts, it will be apparent that wide variations may be made in the mechanical form of the apparatus without departing from the invention as defined in the appended claims.

The agitating chamber 1 is preferably cylindrical in form with an open upper end forming a discharge outlet 2. A rotary shaft 3 extends axially into the interior of the agitating chamber 1. In the form of the device illustrated the shaft 3 is rotated by an electric motor 5 supported upon the top of the apparatus and the lower end of the shaft 3 extends through the bottom of the vessel 1 and is provided with a bearing 6 beneath and exterior to the vessel 1, which is supported upon a suitable standard 30. Leakage from the vessel 1 is prevented by a stuffing-box 4 of any suitable form. For the purpose of protecting the packing in the stuffing-box 4 and the bearing 6 from the injurious action of any of the pulp which might leak past the stuffing-box, I provide a small opening, or duct, 7 leading through the wall of the stuffing-box above the packing therein and opening into an annular chamber 8, which communicates through passage 9 with the lower part of the vessel 1. A constant supply of clear water under sufficient pressure passes through the duct 7 into the vessel 1, thus preventing leakage of any pulp with its contained ore. The

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water so supplied through the passage 7 may, under some conditions of operation, serve the additional purpose of maintaining the pulp in the apparatus at the proper level, that is, the water so supplied may be utilized to compensate for the lowering of level that would otherwise be caused by withdrawing the floating concentrate. The bearing 6 beneath the vessel 1 serves to hold the shaft 3 in proper alignment and to prevent vibration or whipping.

Projecting inwardly from the wall of the cylindrical vessel 1 are a plurality of baffles 10 which take the form of inwardly projecting ribs. These baffles extend upwardly about midway the height of the vessel 1. Upon the shaft 3, adjacent the bottom of the vessel 1, there is secured an agitator or impeller 12, which preferably takes the form of a series of radiating arms, four in number, as shown in the construction illustrated. The radial arms of the agitator 12 extend outwardly with just sufficient clearance for safety between the ends thereof and the baffles 10. A second agitator or impeller 13 is secured to the shaft 3 just above the upper ends of the baffles 10, the radial arms of the upper impeller preferably being longer than those of the lower impeller and having just sufficient clearance between their ends and the wall of the vessel 1 to afford safety of operation.

Rotation of the agitators 12 and 13, in conjunction with the baffles 10, serves to impart a violent agitation to the pulp treated in the apparatus. The lower agitator in conjunction with the baffles imparts a violent agitation to the pulp, thus thoroughly intermingling the ingredients thereof, and also serves through centrifugal force to impart a tendency to the pulp to rise upon the walls of the vessel. The upper agitator 13 lying near the surface of the pulp imparts further rotary movement to the same and centrifugal force causes the pulp to rise upon the walls of the vessel and overflow the upper edge of the same as diagrammatically indicated by the dotted line E in Fig. 1. Of course the precise configuration of the upper surface of the pulp will vary according to conditions such as the speed of agitation and rate of supply of pulp to the apparatus. In order to avoid the possibility of any of the pulp being ejected from the apparatus, I preferably inclose the upper end of the agitating chamber 1 with a hood 14 which surrounds the upper end of the agitating chamber and extends a short distance above the same. The upper end of the hood 14 may be closed by a cover 15. Adjoining the agitating chamber 1 is a separating box 16, the same preferably taking the form of a spitz-box, or box tapering to substantially a point at its lower end.

The hood 14 is closed by a lower wall 17

situated beneath the upper edge or discharge opening 2 of the chamber 1, said wall 17 closing the bottom of the annular space between the agitating chamber and hood and forming a launder to receive the pulp. Just above the wall 17 is a discharge duct 18 leading from the annular space 19 to the upper part of the separating box 16. In order to keep the material in the separating box 16 substantially quiet, I provide a deflector or baffle 20 extending downwardly from the wall of the hood 14 across the opening 18 and spaced sufficiently from the opening 18 to permit free flow of the pulp. I may also provide a second deflector or baffle 21 projecting upwardly across the opening 18 beyond the deflector 20. These deflectors serve to arrest the current of pulp flowing into the separating box and to convey the pulp into the separating box without causing any material disturbance of the pulp therein, thus producing a condition conducive to the formation of the floating concentrate.

At one or more edges the separating box 16 is provided with an overflow lip at substantially the same level as the bottom of the port 18. Said lip is formed by the upper edge of a wall 22, which may be adjustable through a small range, taking the form of a vertically movable gate operated by any suitable means between guides 23. The rate of flow of pulp through the apparatus may be so regulated that the floating material flows over the upper edge of the gate 22 into the launder 24 from which the same may be collected through the discharge opening 11 as a finished concentrate, or for further treatment as the case may be. By reason of the duct 18 and discharge lip of the gate 22 being upon substantially the same level the agitated pulp from the agitating vessel is deposited upon the surface of the pulp in the separator box. I find this to be a distinct advantage over apparatus in which the agitated pulp is discharged into the separator box a considerable distance beneath the surface of the pulp in the separator box.

The lower part of the separating box 1 is connected with the lower part of the agitation vessel 1 by means of a passage 25. The passage 25 opens into the vessel 1 opposite or above the lower agitator 12, the effect of this location of the opening of the passage 25 into the vessel 1 being that the pulp enters the vessel 1 from the separating box 16 against the outward centrifugal force imparted to the material in the vessel 1 by the agitator 12. That is, the flow of pulp from the separating box 16 into the vessel 1 is retarded, but not prevented, by the agitator 12. For the purpose of regulating the flow of pulp from the lower part of the separating box into the vessel 1 the passage 25 is provided with a regulating valve 26, which may be of any suitable form, such as a plug

valve. Pulp is supplied to the apparatus through the pipes or ports 27. These ports 27 are provided with suitable regulating valves 28. After treatment in the apparatus, for one unit thereof, the pulp is withdrawn through the ports 29, which lead from the lower parts of the spitz-boxes.

When the apparatus is used in series, as illustrated in Figs. 2 and 4, the outlet ports 29 from the separating or spitz-boxes 16, communicate with the inlet ports 27, which communicate with the next adjacent agitating vessel. When the apparatus is used as a single unit, either for experimental or practical operations, the inlet port 27 of the agitating vessel 1 is closed after the apparatus is charged with the proper amount of pulp and other ingredients, and the outlet port 29 leading from the spitz-box 16 is also closed until it is desired to discharge the residues or tailings. When operated as a single unit the port 29 is first closed and a suitable amount of pulp with the other necessary ingredients is charged into the apparatus through the port 27, or, if convenient, simply through the open top of the separating box, or in any other convenient manner.

In operating upon a single charge, as above stated, it will be understood that both of the ports 27 and 29 are closed and the port 25 is opened to a suitable extent through manipulation of the valve 26. The charge of pulp supplied to the apparatus is insufficient to fill the same and preferably the level of the pulp before agitation is started is considerably below the upper edge of the chamber 1. The rotation of the agitators 12 and 13 imparts a violent agitation to the mixture of ore, pulp and oil, thus disseminating the oil and causing efficient contact hereof with the metalliferous mineral particles and at the same time impels the pulp mixture upward through the agitating chamber 1 and discharges the same over the top edge, 2, thereof, as hereinbefore explained. The pulp so forced upwardly out of the agitating chamber falls in the annular space 19 between the upper end of the agitating chamber and the surrounding hood and by gravity flows through the duct 18 into the separating box 16, the pulp at the same time flowing from the bottom of the separating box 16 into the lower part of the agitating chamber 1 by reason of the higher head of water established in the separating box 16 due to the discharge of pulp therein through the duct 18. A continuous current of pulp mixture upward through the agitating chamber 1 and downward through the separating box 16 is thereby caused.

The operation as described is to cause the oiled metalliferous part of the ore to float upon the surface of the pulp in the separating box, the surface of which is sub-

stantially quiet. If desired the level of the pulp in the separating box 16 may be so maintained that the floating concentrate as formed will float over the upper edge of the gate 22 into the launder 24. Such regulation of the level of the pulp may be effected in various ways, as by the inflow of water through the passage 7 at the lower end of the agitating vessel. If desired the surface of the pulp in the separating box 16 may be maintained at a point below the upper edge of the gate 24 and the froth as formed may be removed by mechanical means such as skimming.

In the operation of the apparatus as a single unit, as above described, the pulp is thoroughly agitated, together with the materials added thereto, and is impelled upward through the agitating vessel 1, whence it flows through the port 18 into the separating box 16, downward through the separating box and back to the agitating vessel 1 through the port 25. The pulp thus moves through a continuous cycle comprising alternate periods of agitation and quiescence. During the period of quiescence the concentrate which has been sufficiently treated floats upon the surface of the pulp in the separating box 16, while the remainder of the pulp continues to circulate through the agitating vessel and spitz-box. As the pulp so circulates floating concentrate gradually separates therefrom upon the surface of the pulp in the separating box until the material treated is practically exhausted of its valuable content. I have found that in the operation of the apparatus the continuous circulation of the pulp through the separating box and agitating vessel takes place without material interference with the flotation of the concentrate and that the amount of floating concentrate upon the surface of the pulp in the spitz-box gradually increases. A considerable amount of concentrate may be allowed to so accumulate upon the surface of the pulp in the spitz-box before it is necessary to withdraw the same. In operation, however, I find it preferable to remove the float from the surface of the pulp in the spitz-box at intervals or continuously and before too great a volume of float has been built up. As above indicated the removal of the float may be either intermittent and effected by overflow or mechanical means, or the removal of the float may be effected by maintaining a suitable supply of water through the port 7, clear water being supplied when it is desired to treat a definite amount of ore.

A single unit of the apparatus, such as illustrated in Fig. 1, or several units connected in series, as shown in Fig. 2, may be used for the treatment of a continuous flow of pulp through the apparatus. I will first refer to the use of a single unit of the appa-

ratus in operating continuously upon pulp flowing therethrough. When a single unit of the apparatus is used for continuous treatment of ore pulp, as distinguished from a treatment of a single charge, the pulp is supplied to the mixing vessel 1 through the port 27, which need not be located precisely as shown in the drawings, but is preferably located somewhere adjacent the bottom of the mixing vessel. The port 25 is left open, adjustment of the duct through the port, if necessary, being made by means of the valve 26. The pulp carrying with it oil and such other ingredients as necessary for the flotation of pulp flowing in through the port 27 is subjected to violent agitation and to an upward force due to the rotation of the agitator 12 and further agitation and upward impulse is given to the pulp by the rotation of the upper agitator 13. The upward impulse so imparted to the pulp carries the same over the upper edge of the agitation vessel 1 and into the launder 19 and through the port 18 to the separating box 16 as above described. The surface of the pulp in the separating box 16 being substantially quiet the concentrate floats thereon as soon as the material has received sufficient treatment to produce that effect. As the rate of discharge through the port 29 is substantially constant, and as the agitator-impeller moves the pulp from the agitation vessel to the separator box at a more rapid rate, the excess pulp so moved to the separator box will return to the agitation vessel through the port 25, and will continue to move through the local circuit or cycle comprising the agitation vessel, separator box and connecting ports until finally discharged through port 29. By suitable adjustment of the valves and speed of the agitator-impeller the amount of pulp which is moved through this local circuit and the number of cycles of movement imparted to it may be regulated. For instance, if the port 29 be considerably restricted and the port 25 be opened to a relatively large extent, a portion of the pulp will circulate through the circuit formed by the agitation vessel, the port 18, the settling box 16, and the passage 25, a considerable number of times before being discharged through the port 29, the amount of such circulation imparted to the pulp depending, as above stated, upon the degree to which the ports 29 and 25 are opened and will also be influenced by the speed of the agitator. During the operation of the apparatus as described the concentrate will gather as a float upon the surface of the pulp in the settling box 16 and may be removed continuously by regulating the feed through the port 27 in such manner that the floating material will pass over the upper edge of the gate 22 into the concentrate launder 24. Or the float

may be removed intermittently or continuously by mechanical means, such as a skimmer, or by successive intermittent adjustments of the pulp level.

In the use of mechanism, such as heretofore employed in the flotation process, the pulp passes through each agitating vessel but once and successive treatments of the pulp are obtained only by increasing the number of agitating vessels. In my improved apparatus if the working capacity of the apparatus is 500 gallons and 100 gallons per minute are constantly fed through the inlet port 27 and a corresponding amount per minute constantly discharged through the waste port 29, in conjunction with that taken off as concentrate in the concentrate launder 24, there will constantly be in circulation in the apparatus 500 gallons of pulp. Owing to the fact that the agitators impel the pulp at a rate much greater than 100 gallons per minute, a portion of the pulp will circulate through the agitating vessel 1 and separating box 16 many times before it is discharged through the port 29. In other words, the agitator impel the liquid from the agitating vessel into the spitz-box at a more rapid rate than the pulp can be discharged through the waste port 29, and the result is that the material not discharged through the waste port 29 again enters the agitation vessel 1, through the port 25 to again pass through the same circuit until finally withdrawn through the port 29 as waste or into the launder 24 as concentrate. While the flow of pulp from the separating box 16 through the port 25 into the agitation vessel 1 is somewhat resisted by the outward centrifugal force set up by the lower agitator 12, the head of pulp in the separating box 16 when the pulp has risen sufficiently thereon will overcome such resistance and cause the flow of pulp back into the agitation vessel in the course of its circulation through the circuit above described.

When a plurality of units, such as illustrated in Fig. 1, are used in series the several units are connected as shown in Fig. 2, the outlet port 29 of the separating box of the first unit of the series being connected to the inlet port 27 of the agitation vessel of the next unit of the series, the valve 26 serving to control the flow of pulp from one unit to the next. When so used in series the pulp is treated in each unit of the apparatus as heretofore described in connection with the single unit shown in Fig. 1, the pulp it only passing through the entire series of units, but being subjected to local circulation in each unit as above described in connection with the apparatus shown in Fig. 1. The extent of local circulation to which the pulp is subjected in each unit of the series is determined as above described. In 17

improved apparatus when so used in series the pulp instead of being conveyed directly through the several units of the series, as in apparatus heretofore used, is caused to circulate many times through each unit before passing to the next unit of the series, and during such repeated local circulation is subjected to repeated periods of agitation and quiescence for the formation of floating concentrate.

It will be apparent that agitating mechanism different from that herein illustrated and described may be used for agitating the pulp and causing the circulation described above, and that many of the details of construction may be altered without departing from the principle of my invention.

I claim:

1. In a concentrating apparatus, an agitation vessel and separating box communicating with each other through upper and lower ports, and agitating and impelling means in said vessel for agitating an ore pulp therein and adapted to move all of said pulp from said vessel into said box and to move the pulp in a circuit through one of said ports to said box and back through the other port to said vessel, said box having an overflow lip below the level of said upper port.

2. In a device of the class described, an agitation vessel and separating box having communication with each other through ports at the upper and lower parts thereof, and means for imparting agitation to an ore pulp contained in said vessel and for moving all of said pulp from said vessel through said upper port into said box and for causing pulp to circulate repeatedly through said vessel and box, said box having an overflow lip below the level of said upper port.

3. In a device of the class described, an agitation vessel, means therein for agitating and impelling upwardly an ore pulp, a separating box, an upper duct connecting said vessel and box, said agitating and impelling means being adapted to move all of said pulp from said vessel to said box through said upper duct, and a second duct for conducting pulp back to said vessel from said box, said box having an overflow lip below the level of said upper port.

4. In a concentrating apparatus, a mixing vessel and a separator box having communication ports at points adjacent the top and bottom thereof, and a rotary agitator in said vessel adapted by centrifugal force to elevate all of the ore pulp contained therein and thereby to cause said pulp to flow into said separator box through the upper port, said box having an overflow lip below the level of said upper port.

5. In a concentrating apparatus, an agitation vessel and separator box communicating with each other through two ports, means for feeding pulp to said apparatus and for

discharging the same therefrom, and means for agitating said pulp and for moving all of said pulp from said agitation vessel to said separator box at a more rapid rate than the pulp is fed to and discharged from said apparatus, thereby setting up a local circulation of pulp through said vessel, box and connecting ports.

6. In a concentrating apparatus, a mixing vessel and a separator box having communication ports therebetween at points adjacent the top and bottom thereof, said vessel having an ore pulp feed port and said box a tailings discharge port, and a rotary agitator in said vessel adapted to elevate all of the ore pulp supplied thereto and to discharge the same into said box at a more rapid rate than said pulp can be discharged through said discharge port, thereby causing part of said pulp to circulate repeatedly through said vessel and box, said box having an overflow lip below the level of said upper port.

7. In a flotation concentrating apparatus, an agitation vessel having an inlet port for ore pulp, a rotary agitator in said vessel, and a separator box having a discharge lip over which floating concentrate may flow, said vessel and box being connected by a duct above said discharge lip at the upper part of said vessel and opening into said box at substantially the same level as said discharge lip, said agitator being adapted to raise all of the ore pulp supplied to said vessel and to discharge the same through said duct upon the surface of the ore pulp in said box.

8. In a device of the class described, a series of units each comprising an agitation vessel and separating box, the vessel and box of each unit having communication with each other through ports at the upper and lower parts thereof and the box of each unit having communication with the vessel of the next succeeding unit, the first agitation vessel of the series having an inlet port for ore pulp, and means for imparting agitation to the ore pulp in said vessels and for moving all of the ore pulp supplied to each vessel to the communicating box and causing a circulation of pulp through the vessel and box of each unit of the series.

9. In a device of the class described, an agitating vessel having an open upper end, a rotary agitator therein, a launder surrounding the upper end of said vessel to receive ore pulp discharged therefrom, a separator box communicating with said launder, and having an overflow lip below the upper end of said vessel, a duct connecting said box and vessel at a point below said launder, said agitator being adapted to elevate all of the pulp supplied to said vessel and to discharge the same into said box.

10. In a device of the class described, an agitation vessel, having an opening adjacent

its upper end, a separating box having an overflow lip below the level of said opening, a rotary agitator adjacent the bottom of said vessel, and a second rotary agitator above said first named agitator, said second agitator being adapted to operate adjacent the surface of an ore pulp contained in said vessel, said rotary agitators being adapted to elevate all of the ore pulp supplied to said vessel and to discharge the same into said box.

11. In a concentrating apparatus, an agitation vessel and separating box having communication with each other at the upper and lower parts thereof, a rotary agitator adjacent the bottom of said vessel, and a second rotary agitator above said first named agitator, said agitators being adapted to elevate all of the ore pulp supplied to said vessel and to discharge the same into said box thereby causing the pulp to move in a circuit through said vessel and box and to be subjected to alternate periods of agitation in said vessel and substantial quiescence in said box, said separating box having an overflow lip below the level of the upper communication between said vessel and box.

12. In a device of the class described, an agitation vessel having an upper discharge opening, a separating box having an overflow lip below said discharge opening, means for admitting ore pulp to said vessel, means for impelling all of said ore pulp upwardly through said discharge opening to said box, said box being connected with said vessel by a duct leading from the lower part of said box to said vessel.

13. In a device for treating ore pulp, an agitation vessel and separating box, means for admitting ore pulp to said vessel, a wall between said vessel and box, means for maintaining the level of the pulp in said box below the upper edge of said wall, means for impelling all of the pulp supplied to said vessel upwardly and over said wall into said box, and a duct leading from the lower part of said box to said vessel.

In testimony whereof, I have subscribed my name.

THOMAS A. JANNEY.

Witnesses:

WALTER A. SCOTT,

CHARLES E. BURNAP.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents Washington, D. C."

Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Depu.

Defendant's Exhibit No. 35.

MAGNA PLANT
 Flotation Retreatment Plant Results—Treating Mineral Classifier Overflow and 4th and 5th Spigots
 September 1, 1914, to December 24, 1916—Inclusive

Month	HEADING			TAILING			CONCENTRATE			Indicated Extraction	Ratio of Concentra- tion	Lbs. Oil Per Day	Lbs. Oil Per Ton	
	Tonnage	% Cu.	% Fe.	% SiO ₂	% Cu.	% Fe.	% SiO ₂	% Cu.	% Fe.					% SiO ₂
1914														
September	9258	11.55	6.43	69.24	.57	.97	18.27	16.86	34.32	96.67	2.97	41.67	941	3.05
October	10085	10.38	6.31	70.94	.40	1.21	11.20	19.11	36.52	97.21	3.61	45.46	852	2.62
November	13104	9.74	7.00	71.26	.42	1.21	12.19	20.57	34.45	96.87	3.55	50.00	922	2.11
December	11776	10.11	6.25	71.56	.56	1.23	13.93	19.60	35.39	93.70	3.76	40.76	847	2.23
1915														
January	10171	9.43	6.80	70.52	.33	.73	12.64	22.89	32.87	97.51	3.62	42.78	1303	3.97
February	12686	8.13	5.97	74.18	.37	.73	14.93	22.70	32.12	96.38	4.14	44.20	761	1.83
March	16430	8.16	6.08	74.52	.93	.93	19.08	21.58	29.70	91.66	4.09	42.89	641	1.23
April	18350	9.19	6.75	71.42	.48	.69	18.36	20.98	29.29	96.41	3.33	42.13	1133	1.85
May	20229	9.79	6.90	70.60	.29	.69	14.81	21.14	31.93	97.97	3.33	40.42	1434	2.20
June	19036	9.50	6.85	70.58	.42	.75	17.12	20.44	30.14	96.84	3.30	32.10	2607	3.84
July	17613	8.71	6.44	72.69	.43	.64	17.24	20.28	29.92	96.51	3.58	36.58	2629	4.63
August	17778	9.05	6.70	71.76	.29	.60	17.00	20.58	29.78	97.73	3.38	34.72	2185	3.81
September	19014	8.28	6.48	73.09	.40	.58	15.06	22.18	29.62	96.68	3.71	39.40	2445	3.86
October	20792	8.76	6.78	72.48	.35	.64	15.30	21.66	30.08	97.27	3.56	40.85	2530	3.77
November	21211	9.36	7.62	69.36	.32	.58	14.70	22.54	29.00	97.64	3.18	42.08	3058	4.32
December	21216	9.22	7.12	70.56	.22	.54	15.22	21.84	29.73	98.34	3.31	40.56	3225	4.71
1916														
January	18527	8.28	6.36	73.68	.18	.51	15.28	21.61	31.12	98.44	3.86	37.18	3055	5.11
February	19000	7.95	5.42	76.03	.24	.50	14.95	19.80	32.61	97.60	4.28	34.96	3257	4.97
March	20003	7.64	6.51	73.88	.20	.50	16.16	21.16	28.11	98.07	3.76	29.20	3354	5.20
April	21425	7.90	6.51	73.37	.36	.48	18.30	21.06	27.60	96.68	3.62	28.82	3758	5.37
May	24142	7.25	6.06	75.23	.28	.50	19.42	20.74	27.55	97.09	3.91	31.12	3650	4.69
June	28510	7.62	5.78	75.56	.34	.52	16.14	20.84	30.10	96.62	4.12	30.66	3731	3.93
July	29910	7.62	6.00	75.10	.26	.51	15.74	21.53	29.48	97.52	3.96	29.20	3759	3.90
August	30333	7.68	6.08	75.19	.26	.54	16.01	21.19	29.87	97.52	3.98	32.08	3784	3.87
September	30266	7.80	5.90	75.02	.25	.47	17.20	20.62	29.88	97.57	3.93	33.34	3985	3.95
October	32494	7.67	6.07	74.92	.18	.58	14.86	21.18	30.75	98.31	4.08	33.20	3932	3.75
November	30375	7.35	5.70	76.08	.17	.60	17.00	20.40	29.78	98.24	4.13	33.82	3904	3.76
December (24 days)	24429	6.92	5.65	76.70	.12	.54	17.37	20.90	29.09	98.69	4.26	33.45	3803	3.83
AVERAGE	.....	8.350	6.317	73.510	.290	.614	16.116	21.013	30.294	97.461	3.723	36.001	3790	3.790
TOTAL	.....	568163												
AVG. PER DAY	671.6													

R. A. CONRADS,
 Metallurgical Engineer.

Defendant's

UTAH COPPER COM
METALLURGIC

Composite Flotation Retreatment Plant Results for

DATE	HEADING				TAILING			CONCENTRATE				Per Cent Indicated Extraction	Ratio of Concentr'n
	Dry Tons	% Cu.	% Fe.	% SiO ₂	Dry Tons	% Cu.	% Fe.	Dry Tons	% Cu.	% Fe.	% SiO ₂		
December.....	4011	5.616	3.529	83.580	3284	.126	.327	727	33.218	16.433	20.713	98.223	6.170
January.....	28722	6.515	4.958	78.766	22343	.106	.372	6379	29.414	19.664	19.361	98.727	4.573
February.....	26206	6.925	6.028	75.808	20091	.121		6115	29.337	22.637	14.143	98.660	4.294
March.....	31266	6.561	5.871	76.678	23356			22361	27.369	21.691	17.143	97.887	4.261
April.....	7589	6.351	6.092	76.910	5905	.181		7856	24.731	21.618	20.625	95.230	4.089
Total.....	97794				75733	.401		1438					
Average.....	940	6.590	5.566	77.359	725	.157	.366	216	28.458	21.196	17.359	98.161	4.399

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Exhibit No. 36.

PANY—MAGNA PLANT
AL DEPARTMENT

Period December 25, 1916 and April 7, 1917, Inclusive

Pounds New Oil Added	Lbs. Oil in Circu- lation	Excess Lbs. Circulating Oil	Total Lbs. Oil—New, Plus Excess	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Lbs. Ex- cess Cir- culating Oil Per Ton	Total Lbs. Oil Per Ton New, Plus Excess	Dry Tons Pulp in Circulation	Per Cent Solids	Total Lbs. Reagent	Lbs. Reagent Per Ton
63883			63883	15.93			15.93		35.160	8462	2.11
528760	103358	103358	632118	18.41	7.02	3.60	22.01	2555	32.736	71282	2.48
296607	311612	311612	608219	11.32	11.89	11.89	23.21	7372	31.021	94899	3.62
465352	241859	179564	644916	14.88	7.74	5.74	20.62	3599	29.438	111975	3.58
112401	20818	9603	122004	14.81	2.74	1.27	16.08	599	32.165	26023	3.43
1467003	677647	604137	2071140					14125		312641	
14106	6516	5809	19915	15.001	6.929	6.178	21.179	136	31.276	3006	3.197

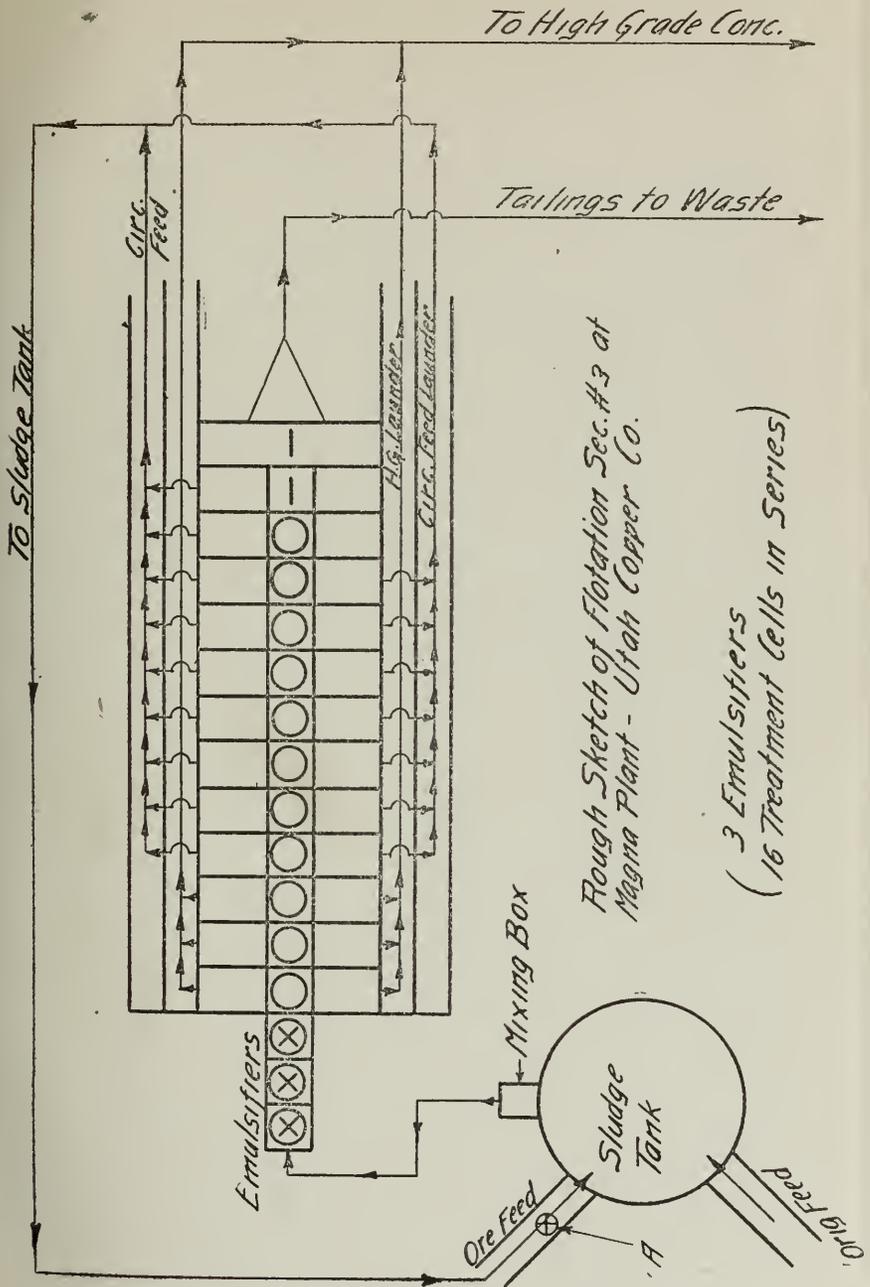
R. A. CONRADS,
Metallurgical Engineer.

[Faint, illegible text]

[Faint, illegible text]

[Faint, illegible text]

Defendant's Exhibit No. 37.



Rough Sketch of Flotation Sec. #3 at Magna Plant - Utah Copper Co.

(3 Emulsifiers
16 Treatment Cells in Series)

Defendant's

UTAH COPPER COMPANY
METALLURGICAL

Statement Showing Loss in Pounds of Copper and Consequent Monetary Losses Due to
—Comparisons Being Made Between a Normal Period from December 25, 1916
—Copper Figured at 15¢ per Pound

DATE	Avg. Lbs. Oil Used Per Ton Ore Treated	Avg. Dry Tons Treated Per Day	Average % Cu. in Tailing	Average % Cu. in Concent.	Average % Fe. in Concent.	Average % SiO ₂ in Concent.	Ratio of Concentration	Average Tons Tailing Per Day	Average % Cu. in Tailing	Loss Lbs. Cu. Per Ton	Loss Per Ton @ 15¢ Cu.	P. @
NORMAL												
12/25/16 to 3/24/17*	22.18	926	.120	29.09	21.04	16.99	4.44	715	.120	2.40	.360	
March 25 *A	16.17	1075	.241	27.29	23.27	13.27	4.37	829	.241	4.82	.723	
March 26 *A	15.84	1083	.278	28.45	22.00	14.63	4.34	833	.278	5.56	.834	
March 27	16.33	1021	.249	24.65	22.86	16.90	4.18	777	.249	4.98	.747	
March 28	16.41	1013	.300	23.12	24.01	16.80	3.84	749	.300	6.00	.900	
March 29	NO TESTS MADE											
March 30	10.63	750	.589	24.39	20.10	25.40	4.67	590	.589	11.78	1.767	
March 31 *B	10.33	991	.486	24.75	23.51	18.17	4.36	764	.486	9.72	1.458	
April 1	5.16	1098	.560	21.78	21.98	22.63	3.76	806	.560	11.20	1.680	
April 2 *C	4.16	1086	1.277	27.09	19.58	23.32	4.40	839	1.277	25.54	3.831	

* Dec. 25, 1916, to Jan. 16, 1917, inclusive, no oil credited from circulation. Jan. 17th to March 3rd, inclusive, all circulated oil credited as new oil.
March 4th to 24th, inclusive, circulated oil in excess of 20 lbs. per ton dry pulp in circulation, credited as new oil

* A Inclusive of the circulating oil in excess of 15 lbs. per ton of dry pulp in circulation.

* B Inclusive of the circulating oil in excess of 10 lbs. per ton of dry pulp in circulation.

* C Inclusive of the circulating oil in excess of 5 lbs. per ton of dry pulp in circulation.

Magna Utah.

April 16, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Exhibit No. 38.

NEW YORK—MAGNA PLANT

DEPARTMENT

Abnormal Tailing Caused by Variation in Amounts of Oil Used per Ton of Ore Treated.

From March 16, to March 24, 1917—And Abnormal Days from March 25 to April 2, 1917.

at Various Prices.

Loss Per Ton @ 20c Cu.	Loss Per Ton @ 25c Cu.	Loss Per Ton @ 30c Cu.	Abnormal Loss Lbs. Cu. Per Ton Tailing	Abnormal Loss Per Ton @ 15c Cu.	Abnormal Loss Per Day @ 15c Cu.	Abnormal Loss Per Ton @ 20c Cu.	Abnormal Loss Per Day @ 20c Cu.	Abnormal Loss Per Ton @ 25c Cu.	Abnormal Loss Per Day @ 25c Cu.	Abnormal Loss Per Ton @ 30c Cu.	Abnormal Loss Per Day @ 30c Cu.
.480	.600	.720									
.964	1.205	1.446	2.42	.363	300.93	.484	401.24	.605	501.54	.726	601.85
1.112	1.390	1.668	3.16	.474	394.84	.632	526.46	.790	658.07	.948	789.68
1.996	1.245	1.494	2.58	.387	300.70	.516	400.93	.645	501.16	.774	601.40
1.200	1.500	1.800	3.60	.540	404.46	.720	539.28	.900	674.10	1.080	808.92
356	2.945	3.534	9.38	1.407	830.13	1.876	1106.84	2.345	1383.55	2.814	1660.26
944	2.430	2.916	7.32	1.098	838.87	1.464	1118.50	1.830	1398.12	2.196	1677.74
240	2.800	3.360	8.80	1.320	1063.92	1.760	1418.56	2.200	1773.20	2.640	2127.84
108	6.385	7.662	23.14	3.471	2912.17	4.628	3882.89	5.785	4853.62	6.942	5824.34

based on new oil.



Defendant

UTAH COPPER CORP.
METALLURGY

Composite Flotation Retreatment Plant

DATE	HEADING			TAILING			CONCENTRATE				Ratio of Concentrate	
	Dry Tons	% Cu.	% Fe.	% SiO ₂	Dry Tons	% Cu.	% Fe.	% SiO ₂	Dry Tons	% Cu.		% Fe.	% SiO_{2}
12/25.....	340	4.77	3.75	83.47	284	.110	.33	56	28.60	19.05	20.80	6.11
12/26.....	92	4.37	2.92	88.00	82	.085	.37	10	39.53	12.72	17.00	9.20
12/27.....	572	5.59	2.55	85.00	488	.087	.37	84	37.34	13.39	22.80	6.77
12/28.....	715	5.95	2.97	84.20	598	.193	.29	117	35.55	14.60	22.13	6.14
12/29.....	794	6.56	3.90	81.53	644	.264	.30	150	33.58	17.03	19.33	5.29
12/30.....	746	6.34	3.93	81.87	593	.074	.33	153	30.64	17.67	21.13	4.88
12/31.....	752	5.73	4.68	81.00	595	.067	.30	157	27.28	20.57	21.80	4.80
Total.....	4011				3284			727				
Average..	573	5.616	3.529	83.58	469	.126	.327	104	33.218	16.433	20.713	6.170

Magna, Utah,
February 3, 1917.Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Report No. 39.

—MAGNA PLANT
DEPARTMENT

—December 25th to 31, 1916, Inclusive

OIL							REAGENTS	
ORIGINAL FEED			Oil Com- bination	No. of Cells Pro- ducing Finished Concen- trate	No. of Cells Circulat- ing	Total Lbs.	Pounds Per Ton	
Lbs. Oil Entering Head of Machine	Lbs. Oil Per Ton	Circu- lating Feed % Solids						
5,242	15.42	26.83	95% J; 5% Yar. P. ‡	3-5	13-11	759	2.23	
1,451	15.77	No Sample	"	4	12	392	4.26	
6,551	11.45	33.05	"	4	12	1135	1.98	
9,361	13.09	34.33	"	4-6	12-10	1230	1.72	
11,051	13.92	38.42	"	4-6	12-10	1686	2.12	
14,642	19.63	39.44	"	4-6	12-10	1657	2.22	
15,585	20.72	38.88	"	5	11	1603	2.13	
63,833						8462		
9,126	15.93	35.16				1209	2.11	

‡ Oils Initialed:

I—Jones.

Y—Yaryan Pine.

Defendant's Ex

UTAH COPPER COMPANY
METALLURGICAL

Composite Flotation Retreatment Plant

DATE	HEADING				TAILING			CONCENTRATE				Ratio of Concentration	Per Cent Indicated Extraction	Pounds New Oil Added	Lbs. Oil in Circulation	Total Oil Entering Head of Machine
	Dry Tons	% Cu.	% Fe.	% SiO ₂	Dry Tons	% Cu.	% Fe.	Dry Tons	% Cu.	% Fe.	% SiO ₂					
1.....	739	5.97	4.13	81.33	583	.084	.32	156	27.98	18.87	22.00	4.74	98.92	15724		15724
2.....	811	6.50	3.57	80.27	653	.094	.30	158	33.04	16.17	22.33	5.14	98.84	17643		17643
3.....	839	6.08	3.80	82.67	678	.065	.33	161	31.35	17.67	20.80	5.20	99.16	17503		17503
4.....	863	6.87	3.40	82.13	705	.092	.32	158	37.20	15.27	19.13	5.47	98.90	18064		18064
5.....	861	6.37	3.22	83.46	703	.148	.31	158	34.01	15.05	30.21	5.44	98.10	18484		18484
6.....	790	6.37	2.97	81.93	644	.130	.24	146	33.97	14.58	22.03	5.42	98.33	19809		19809
7.....	896	6.27	3.23	83.20	726	.093	.28	170	32.67	15.13	22.60	5.27	98.82	18691		18691
8.....	884	5.69	4.43	82.00	703	.112	.31	181	27.41	18.93	23.30	4.89	98.45	18999		18999
9.....	860	6.21	4.53	80.60	676	.067	.32	184	28.83	17.30	24.47	4.68	99.16	19043		19043
10.....	838	6.75	4.30	80.00	669	.110	.52	169	33.02	19.70	19.07	4.96	98.69	18855		18855
11.....	911	6.60	5.48	77.80	703	.107	.32	208	28.57	21.78	18.00	4.38	98.78	18949		18949
12.....	906	6.80	5.95	77.60	683	.097	.48	223	27.35	20.97	21.20	4.06	98.92	19417		19417
13.....	880	6.43	5.38	78.33	677	.144	.38	203	27.37	20.74	17.53	4.33	98.23	19276		19276
14.....	1029	6.45	6.07	76.86	783	.138	.36	246	26.49	22.71	15.55	4.17	98.35	23205		23205
15.....	940	7.44	4.88	77.70	717	.096	.29	223	31.15	18.58	18.02	4.23	99.05	22356		22356
16.....	949	6.70	4.86	78.04	715	.055	.35	234	27.10	17.37	25.35	4.07	99.39	20490		20490
17.....	922	6.72	4.49	78.73	705	.068	.37	217	28.62	16.76	24.95	4.26	99.22	16746	4259	21005
18.....	948	6.86	4.76	77.74	715	.067	.38	233	27.65	17.27	23.85	4.06	99.26	17336	4970	22306
19.....	964	6.75	4.62	79.97	746	.060	.28	218	29.57	18.07	21.75	4.41	99.30	15746	6010	21756
20.....	997	6.98	4.49	78.94	805	.124	.32	192	35.75	18.84	14.47	5.20	98.55	15308	5492	20800
21.....	994	6.20	4.76	79.90	787	.141	.41	207	29.20	21.60	15.17	4.80	98.17	15560	5967	21527
22.....	1023	7.15	4.99	78.00	807	.144	.35	216	33.25	20.12	13.57	4.72	98.39	14204	7244	21448
23.....	979	6.76	5.48	77.26	773	.093	.50	206	31.69	20.31	16.07	4.74	98.92	13372	4994	18366
24.....	982	6.67	5.64	75.86	759	.128	.49	223	28.93	21.67	15.47	4.40	98.54	14228	5278	19506
25.....	1017	5.75	6.25	76.24	775	.111	.37	242	23.80	24.22	17.14	4.20	98.53	14350	6899	21249
26.....	1003	6.25	6.12	76.84	762	.089	.40	241	25.67	22.87	17.47	4.15	98.88	14365	5863	20228
27.....	950	5.42	6.83	75.65	721	.100	.54	229	22.13	24.56	17.88	4.14	98.58	13654	6398	20052
28.....	966	6.75	6.64	74.80	702	.127	.40	264	24.40	23.68	15.90	3.66	98.66	14212	5005	19217
29.....	1006	7.01	5.85	76.76	766	.165	.36	240	28.78	21.64	17.12	4.18	98.20	15260	8977	24237
30.....	986	6.27	7.11	74.54	732	.111	.37	254	24.03	25.59	14.30	3.88	98.67	14632	11817	26449
31.....	989	6.94	5.48	76.60	770	.124	.56	219	30.86	21.47	13.50	4.51	98.59	13279	14185	27464
Total.....	28722				22343			6379						528760	103358	632118
Average.....	927	6.515	4.958	78.766	721	.106	.372	206	29.414	19.664	19.361	4.573	98.727	17057	6891	20391
Avg. to Date.....	861	6.404	4.783	79.356	674	.109	.366	187	29.803	19.333	19.499	4.768	98.665	15596	6891	18316

Magna, Utah,
February 3, 1917.

‡‡ Oils Initialed:
 J—Jones.
 Y P—Yaryan Pine.
 S F—Smelter Fuel.
 A C—American Creosote.

hibit No. 40.

NY—MAGNA PLANT

DEPARTMENT

at Results—Month of January, 1917

ORIGINAL FEED			CIRCULATING FEED			Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulation	REAGENT	
Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil Per Ton in Circulation	Per Cent Solids				Total Lbs.	Pounds Per Ton
21.28		21.28			38.36	95% J; 5% Y. P. ††	5-6	11-10	1742	2.36
21.75		21.75			37.19	"	5	11	1714	2.11
20.86		20.86			37.80	"	4-5	12-11	1430	1.70
20.93		20.93			39.50	"	5	11	1882	2.18
21.47		21.47			40.02	"	5-6	11-10	1574	1.83
25.07		25.07			38.50	97% J; 3% Y. P.	4-6	12-10	1575	1.99
20.86		20.86			40.24	97.5% J; 2.5% Y. P.	5-6	11-10	2106	2.35
21.49		21.49			39.31	97% J; 3% Y. P.; 98% J; 2% Y. P.	5-6	11-10	1743	1.97
22.14		22.14			39.81	"	5-6	11-10	1992	2.32
22.50		22.50			36.31	98% J; 2% Y. P.	5-6	11-10	1715	2.05
20.80		20.80			39.92	"	5-6	11-10	1836	3.02
21.43		21.43			37.80	"	4-6	12-10	1760	1.94
21.90		21.90			38.11	"	3-6	13-10	1855	2.11
22.55		22.55			32.20	"	2-3-6	14-13-10	2722	2.64
23.78		23.78			29.42	98% J; 2% Y. P.; 83% S. F.; 15% A. C.; 2% Y. P.	2-5	14-11	2907	3.09
21.59		21.59			26.80	83% S. F.; 15% A. C.; 2% Y. P.	2-3	14-13	1818	1.92
18.16	4.62	22.78	125	34.07	25.82	"	2	14	1632	1.77
18.29	5.24	23.53	208	23.89	25.52	"	2-3-4	14-13-12	3106	3.28
16.33	6.23	22.56	164	36.65	24.26	83% S. F.; 15% A. C.; 2% Y. P.; 100% S. F.	2-3-4	14-13-12	2287	2.37
15.35	5.51	20.86	106	51.81	28.11	100% S. F.—82.35% S. F.; 17.65% J.	3-4	13-12	2517	2.52
15.65	6.00	21.65	173	34.49	32.52	82.35% S. F.; 17.65% J; 89% S. F.; 11% J.	3-4-5-	13-12-11	2044	2.06
13.88	7.08	20.96	165	43.90	29.58	89% S. F.; 11% J; 98% J; 2% Y. P.	2-3-4-	14-13-12	3557	3.48
13.66	5.10	18.76	134	37.27	28.41	98% J; 2% Y. P.	2-3	14-13	2942	3.00
19.86	5.37	19.86	156	33.83	29.88	"	2-3	14-13	2498	2.54
14.11	6.78	20.89	160	43.12	29.18	"	2-	14	2702	2.66
14.32	5.85	20.17	154	38.07	26.78	"	2-3	14-13	2814	2.80
14.37	6.73	21.10	128	49.98	27.91	"	2	14	2533	2.67
14.71	5.18	19.89	180	27.81	28.70	"	2	14	2804	2.90
15.17	8.92	24.09	181	49.60	27.70	"	2-3-4	14-13-12	3262	3.24
14.84	11.98	26.82	233	50.72	29.82	"	2	14	3073	3.12
13.43	14.34	27.77	288	49.25	29.34	"	2	14	3140	3.17
			2555						71282	
18.41	7.02	22.01	170	40.45	32.736				2299	2.48
18.11	7.02	21.27	170	40.45	33.036				2099	2.43

R. A. CONRADS,
Metallurgical Engineer.

Defendant's E

UTAH COPPER COMP

METALLURGICA

Composite Flotation Retreatment Pla

DATE	HEADING				TAILING		CONCENTRATE				Ratio of Concentration	Per Cent Indicated Extraction	Pounds New Oil Added	Lbs. Oil in Circulation	Total Enter Head Mach
	Dry Tons	% Cu.	% Fe.	% SiO2	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	% SiO2					
1.....	915	7.02	4.85	78.30	729	.136	186	33.99	19.24	15.77	4.92	98.44	10382	12142	225
2.....	941	6.40	5.38	78.04	748	.108	193	30.78	20.44	16.10	4.88	98.68	8615	10654	192
3.....	947	6.21	6.25	74.18	727	.180	220	26.13	22.24	17.81	4.30	97.83	10007	11628	216
4.....	955	6.41	5.76	76.30	743	.134	212	28.44	22.26	17.04	4.51	98.40	9824	12083	219
5.....	1011	6.70	5.85	76.20	779	.088	232	28.93	22.59	16.00	4.36	99.02	8791	9501	182
6.....	943	6.34	6.58	75.10	724	.107	219	26.94	24.49	13.67	4.30	98.71	11275	6888	181
7.....	956	6.43	5.61	77.53	749	.095	207	29.39	22.43	14.77	4.62	98.83	13232	9317	225
8.....	985	6.30	5.77	77.40	767	.102	218	28.10	23.43	13.87	4.52	98.75	12727	9184	219
9.....	992	6.61	5.34	78.10	781	.131	211	30.66	21.21	14.67	4.71	98.46	13099	10314	234
10.....	939	7.05	6.03	76.50	708	.129	231	28.28	22.50	15.77	4.07	98.59	11863	10749	226
11.....	909	7.48	5.48	76.53	702	.106	207	32.46	21.33	13.60	4.39	98.92	12874	9555	224
12.....	881	7.55	5.88	75.23	665	.103	216	30.45	22.37	12.50	4.08	99.00	12245	9194	214
13.....	915	6.91	7.76	74.17	678	.094	237	26.42	25.16	12.30	3.86	99.01	11687	15767	274
14.....	917	7.65	5.57	74.90	705	.108	212	32.66	22.06	12.77	4.32	98.92	9739	11567	213
15.....	958	7.13	6.60	74.20	724	.122	234	28.77	24.43	13.73	4.09	98.68	9211	15870	250
16.....	876	7.46	6.47	74.55	665	.127	211	30.54	23.41	11.57	4.15	98.68	8125	10232	183
17.....	904	7.33	6.73	73.70	677	.148	227	28.73	23.74	11.98	3.98	98.47	8885	12734	216
18.....	917	8.07	5.37	75.07	706	.140	211	34.58	21.06	12.10	4.34	98.67	8839	10294	191
19.....	924	7.20	6.70	74.23	702	.140	222	29.56	23.80	12.20	4.17	98.54	8645	11886	205
20.....	919	7.59	5.62	75.13	700	.161	219	31.40	21.70	14.03	4.20	98.40	8924	11272	201
21.....	951	7.38	6.21	75.63	719	.112	232	29.82	22.71	14.15	4.09	98.86	8738	14660	233
22.....	915	7.07	5.96	75.72	702	.159	213	29.87	22.86	13.60	4.30	98.28	7783	20332	281
23.....	916	6.83	6.09	76.27	703	.114	213	29.01	23.67	13.03	4.30	98.68	7170	15277	224
24.....	967	6.46	5.89	76.77	744	.120	223	27.65	23.31	14.50	4.34	98.59	7124	12631	197
25.....	911	6.32	6.37	76.27	699	.127	212	26.69	23.51	13.07	4.29	98.45	12067	12533	246
26.....	906	6.48	5.79	76.43	705	.112	201	28.78	22.01	14.70	4.50	98.65	13153	4402	175
27.....	956	6.79	6.09	76.13	722	.094	234	27.48	22.31	16.08	4.09	98.92	14107	4741	188
28.....	980	6.73	6.78	74.07	718	.102	262	24.92	23.58	14.62	3.74	98.92	17476	6205	236
Total.....	26206				20091		6115						296607	311612	6082
Average.....	936	6.9161	6.028	75.808	717.5	.1212	218.4	29.241	22.637	14.143	4.294	98.655	10593	11129	217
Avg. to Date....	893	6.636	5.337	77.779	693	.114	200	29.587	20.861	17.022	4.519	98.666	13474	6288	197

Magna, Utah,
March 2, 1917.

Exhibit No. 41.

MANY—MAGNA PLANT

L. DEPARTMENT

Plant Results—Month of February, 1917

ORIGINAL FEED				CIRCULATING FEED			Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	REAGENT	
Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil Per Ton in Circulation	Per Cent Solids	Total Lbs.				Pounds Per Ton	
11.35	13.27	24.62	259	46.88	32.03	98% J; 2% Y. P. †	4	12	3010	3.29	
9.16	11.32	20.48	323	32.98	33.17	"	2	14	2973	3.16	
10.57	12.28	22.85	325	35.78	32.14	"	2	14	2589	2.73	
10.29	12.65	22.94	321	37.64	31.24	"	2	14	2925	3.06	
8.70	9.40	18.10	335	28.36	30.92	"	2	14	2777	2.75	
11.96	7.30	19.26	278	24.78	32.35	98% J; 2% Y. P.; 80% J; 20% A. C.	2-4	14-12	3122	3.31	
13.84	9.75	23.59	184	50.64	31.43	80% J; 20% A. C.; 87½% J; 11½% A. C.; 1% Y. P.	2-4	14-12	3233	3.38	
12.92	9.32	22.24	242	37.95	31.27	87½% J; 11½% A. C.; 1% Y. P.	4-7	12-9	3624	3.68	
13.20	10.40	23.60	228	45.24	30.96	"	4-6	12-10	3037	3.06	
12.63	11.45	24.08	236	45.55	30.77	(87½% J; 11½% A. C.; 1% Y. P.; 42% J. (52% S. F.; 5½% A. C.; ½% Y. P. 87½% J; 11½% A. C.; 1% Y. P.	4-6	12-10	3261	3.47	
14.16	10.51	24.67	262	36.47	29.12	"	4	12	3233	3.56	
13.90	10.44	24.34	271	33.93	27.11	"	4-5	12-11	3448	3.91	
12.77	17.23	30.00	273	57.75	30.38	"	4-5	12-11	3241	3.54	
10.62	12.61	23.23	266	43.48	31.68	"	4-5	12-11	3448	3.76	
9.61	16.57	26.18	305	52.03	31.66	"	4-5	12-11	3177	3.32	
9.28	11.68	20.96	327	31.29	32.29	"	4-6	12-10	3317	3.79	
9.83	14.09	23.92	334	38.12	31.02	"	4-5	12-11	3451	3.82	
9.64	11.23	20.87	310	33.21	32.24	"	4-5	12-11	3714	4.05	
9.36	12.86	22.22	321	37.03	33.47	"	4-5	12-11	3531	3.82	
9.71	12.27	21.98	279	40.40	32.83	"	4-6	12-10	3961	4.31	
9.19	15.42	24.61	296	49.53	31.90	"	4-6	12-10	3663	3.85	
8.51	22.22	30.73	284	71.59	30.26	"	4-6	12-10	4319	4.72	
7.83	16.68	24.51	259	58.98	30.10	"	4-5	12-11	4398	4.80	
7.37	13.06	20.43	254	49.73	27.98	"	4-6	12-10	3532	3.65	
13.25	13.75	27.00	176	71.21	29.64	"	4-6	12-10	3765	4.13	
14.52	4.86	19.38	131	33.60	30.57	"	4-6	12-10	3550	3.92	
14.76	4.96	19.72	143	33.15	29.98	"	6-8	10-8	3307	3.46	
17.83	6.33	24.16	150	41.37	30.08	"	6-8	10-8	3293	3.36	
									94899		
			7372								
11.32	11.89	23.21	263	42.27	31.021						
15.09	7.04	22.13	150	41.92	32.140						
									3389	3.62	
									2646	2.96	

† Oils Initialed:

J—Jones.
 Y P—Yaryan Pine.
 S F—Smelter Fuel.
 A C—American Creosote.

R. A. CONRADS,

Metallurgical Engineer.

Defendant's
UTAH COPPER CO.
METALLURGY
Composite Flotation Retreatment

DATE	HEADING				TAILING		CONCENTRATE				Ratio of Concentration	Per Cent Indicated Extraction	Pounds New Oil Added	Lbs. Oil in Circulation	Debit	
	Dry Tons	% Cu.	% Fe.	% SiO ₂	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	% SiO ₂						
3/1.....	1	011	6.77	5.45	77.43	772	.087	239	28.37	20.90	17.27	4.23	99.01	15675	6988	
2.....		954	6.66	4.78	78.80	754	.086	200	31.43	20.04	15.47	4.77	98.95	15147	5482	
3.....	1	054	6.33	4.61	79.30	826	.072	228	29.02	21.11	17.57	4.62	99.13	17188	6216	
4.....		995	6.18	5.69	77.50	763	.177	232	25.89	21.29	18.47	4.28	97.80	17989	5333	2240
5.....	1	006	6.83	5.70	76.37	758	.220	245	27.09	21.40	19.37	4.06	97.60	18845	7079	2740
6.....		986	6.43	5.39	78.80	772	.208	214	28.91	20.68	17.43	4.61	97.45	16913	6994	2060
7.....	1	024	7.80	5.69	75.50	763	.189	261	30.04	19.30	18.47	3.92	98.20	16819	8223	2780
8.....	1	080	7.97	5.96	74.80	800	.243	280	30.06	21.26	15.43	3.86	97.77	17327	6594	2360
9.....	1	111	6.66	6.92	74.50	835	.183	276	26.25	23.15	16.07	4.02	97.93	18063	7606	2760
10.....	1	057	7.43	6.32	75.00	782	.206	275	27.93	22.86	14.43	3.84	97.96	17297	9641	2540
11.....	1	060	7.14	6.25	75.67	772	.144	288	25.92	21.93	17.88	3.68	98.53	17404	13982	3840
12.....	1	044	7.68	5.74	76.18	762	.100	282	28.15	19.18	22.72	3.70	99.07	18030	12586	3700
13.....		988	7.25	5.64	76.00	748	.134	240	29.36	20.46	17.50	4.11	98.58	17114	13267	3800
14.....		965	6.25	5.73	77.03	751	.073	214	27.91	21.91	15.47	4.51	99.08	14695	18453	3200
15.....		954	5.87	5.45	77.83	760	.083	194	28.56	22.07	17.37	4.92	98.86	12958	12720	2900
16.....		942	5.76	5.75	78.13	738	.102	204	26.25	23.47	14.53	4.62	98.60	11851	9594	2460
17.....		958	6.00	5.70	77.33	738	.130	220	25.67	22.08	18.60	4.35	98.37	11559	12028	2800
18.....		964	5.96	6.04	77.30	748	.104	216	26.24	22.23	17.17	4.46	98.65	12428	10831	2840
19.....	1	031	6.11	5.94	76.12	789	.164	242	25.50	22.38	17.63	4.26	97.93	12768	11656	3520
20.....	1	019	7.04	5.87	76.10	779	.123	240	29.44	20.48	17.10	4.24	98.64	13654	8420	2720
21.....	1	043	6.39	6.60	76.15	799	.111	244	26.97	22.15	14.95	4.28	98.66	16633	7305	2160
22.....		986	6.10	5.52	77.87	775	.092	211	28.19	20.84	16.60	4.68	98.83	15706	7661	1960
23.....	1	090	6.40	5.55	78.37	860	.095	230	29.94	20.66	15.08	4.73	98.85	15938	6924	1960
24.....	1	052	6.35	6.08	77.13	814	.134	238	27.62	22.76	13.60	4.42	98.40	16326	7352	2180
25.....	1	075	6.43	6.25	75.90	829	.241	246	27.29	23.27	13.27	4.37	97.12	11473	7589	1680
26.....	1	083	6.77	5.95	75.93	833	.278	250	28.45	22.00	14.63	4.34	96.85	11960	6776	1575
27.....	1	021	6.08	6.51	76.13	777	.249	244	24.65	22.86	16.90	4.18	96.83	16669		
28.....	1	013	6.24	7.05	74.73	749	.300	264	23.12	24.01	16.80	3.84	96.42	16622		
29.....		959	6.78	6.22	75.90	705	.198	254	25.09	22.08	20.07	3.78	97.81	14456	1514	840
30.....		750	5.69	5.25	78.13	590	.589	160	24.39	20.10	25.40	4.67	91.88	7974		
31.....		991	6.05	6.41	75.10	764	.486	227	24.75	23.51	18.17	4.36	93.80	7871	3045	680
Total.....	31	266				23915		7358						465352	241859	62295
Average.....	1	008.58	6.580	5.871	76.678	771.4	.1774	237.4	27.371	21.691	17.143	4.261	97.894	15011	8638	2010
Avg. to Date.....		930	6.610	5.522	77.397	718	.137	212	28.794	21.158	17.065	4.335	98.395	13965		

465352 + 241859 =

** Oils Initialed:

L F—Lyoth Fuel.

J—Jones.

Y P—Yaryan Pine.

A C—American Creosote.

Magna, Utah,
 April 8, 1917.

Exhibit No. 42.

COMPANY—MAGNA PLANT

LABORATORY DEPARTMENT

Plant Results—Month of March, 1917

O I L												
ORIGINAL FEED					CIRCULATING FEED			REAGENTS				
Credit	Total Oil Entering Head of Machine	Pounds New Oil Per Ton	Pounds Circulating Oil Per Ton	Total Lbs. Oil Per Ton	Total Tons	Pounds Oil per Ton in Circulation	Per Cent Solids	Oil Combinations	No. of Cells Producing Finished Concentrate	No. of Cells Circulating	Total Lbs.	Pounds Per Ton
6988	22663	15.50	6.91	22.41	149	46.90	25.13	87½% J., 11½% A. C., 1% Y. P. **	6-7	10-9	3188	3.15
5482	20629	15.87	5.75	21.63	109	50.29	27.43	" "	6-8	10-8	3486	3.65
6216	23404	16.30	5.90	22.20	136	45.71	28.49	86% J., 12½% A. C., 1½% Y. P.	6-8	10-8	3136	2.98
3093	21082	18.08	3.11	21.19	112	47.62	30.91	Lyoth Fuel Oil.	6-7	10-9	3839	3.86
4339	23184	18.73	4.31	23.04	137	51.67	31.06	" " "	6-8	10-8	4661	4.63
4934	21847	17.15	5.00	22.15	103	67.90	32.02	" " "	6-10	10-6	4092	4.15
5443	22262	16.42	5.32	21.74	139	59.16	29.31	" " "	6-7	10-9	3834	3.74
4234	21561	16.04	3.92	19.96	118	55.88	32.56	" " " & 59% L. F., 41% J.	6-11	10-5	4311	3.99
4846	22909	16.26	4.36	20.62	138	55.12	34.18	59% Lyoth Fuel & 41% J.	7-11	9-5	4511	4.06
7101	24398	16.36	6.72	23.08	127	75.91	29.19	59% L. F., 41% J; 86% J., 12½% A. C., 1½% Y. P.	6-8	10-8	4216	3.99
10142	27546	16.42	9.57	25.99	194	72.07	28.84	86% J., 12½% A. C., 1½% Y. P., 43% L. F., 43% J., 12½% AC 1½% Y. P.	8-9	8-7	3546	3.34
8886	26916	17.27	8.51	25.78	185	68.03	26.14	43% J., 43% L. F., 12½% A. C., 1½% Y. P.	6-9	10-7	3062	2.93
9467	26581	17.32	9.58	26.90	190	69.83	26.43	43% J., 43% L. F., 12½% A. C., 1½% Y. P.	6-10	10-6	3419	3.46
15253	29948	15.23	15.81	31.04	160	115.33	25.93	" "	6-8	10-8	2912	3.02
9820	22778	13.58	10.29	23.87	145	87.72	25.57	" "	6-8	10-8	2902	3.04
7134	18985	12.58	7.57	20.15	123	78.00	25.29	" "	6-8	10-8	2403	2.55
9228	20787	12.07	9.63	21.70	140	85.91	26.06	" "	6-8	10-8	2617	2.73
7991	20419	12.89	8.29	21.18	142	76.27	26.44	" "	6-8	10-8	3060	3.17
8136	20904	12.38	7.89	20.27	176	66.23	26.98	" "	6-10	10-6	3961	3.84
5700	19354	13.40	5.59	18.99	136	61.91	27.57	" "	6-9	10-7	4056	3.98
5145	21778	15.95	4.93	20.88	108	67.64	26.70	82½% Fuel and 17½% A. C.	7-8	9-8	4153	3.98
5701	21407	15.93	5.78	21.71	98	78.17	25.56	" "	5-8	11-8	2656	2.69
4964	20902	14.62	4.55	19.17	98	70.65	26.83	" "	6-8	10-8	2411	2.21
5172	21498	15.52	4.92	20.44	109	67.45	28.24	" "	8-10	8-6	3229	3.07
5909	17382	10.67	5.50	16.17	112	67.76	31.39	50% J., 37½% F., 12½% A. C.	4-5	12.11	3864	3.59
5201	17161	11.04	4.80	15.84	105	64.53	32.94	" "	4-5	12.11	3990	3.68
	16669	16.33		16.33			32.51	" "	All	None	4598	4.60
	16622	16.41		16.41			32.64	" "	"	"	4741	4.68
674	15130	15.07	.71	15.78	42	36.04	33.44	" "	4-16	12-0	3887	4.05
	7974	10.63		10.63			40.52	" "	All	None	3584	4.78
2365	10236	7.94	2.39	10.33	68	44.78	36.27	" "	5-6	11-10	3553	3.58
79564	644916				3599						111975	
5792	20803	14.837	6.343	21.180	116	49.89	29.438				3612	3.581
6129	20094	15.02	6.59	21.61	139	44.09	31.203				2955	3.177
707211												

R. A. CONRADS,
Metallurgical Engineer.

Defendant's E

UTAH COPPER COMP
METALLURGICA

Composite Flotation Retreatment Plant Results

DATE	HEADING				TAILING		CONCENTRATE				Per Cent Indicated Extraction
	Dry Tons	% Cu.	% Fe.	% SiO ₂	Dry Tons	% Cu.	Dry Tons	% Cu.	% Fe.	% SiO ₂	
4/1.....	1098	6.21	6.65	74.80	806	.560	292	21.78	21.98	22.63	93.40
2.....	1086	7.14	5.74	76.27	839	1.277	247	27.09	19.58	23.32	86.16
3.....	1095	6.23	6.43	76.77	814	.127	281	23.91	22.65	19.47	98.45
4.....	1090	5.67	6.22	77.68	830	.116	260	23.38	22.44	19.33	98.41
5.....	1104	5.66	6.66	77.10	827	.164	277	22.07	22.89	20.47	97.82
6.....	1077	6.15	5.41	78.40	828	.243	249	25.76	21.44	20.50	97.00
7.....	1039	7.46	5.48	77.40	789	.307	250	30.10	19.96	18.57	96.89
TOTAL.....	7589				5733		1856				
AVERAGE.....	1084	6.351	6.092	76.910	819	.401	265	24.731	21.618	20.625	95.230

Magna, Utah,
April 8, 1917.

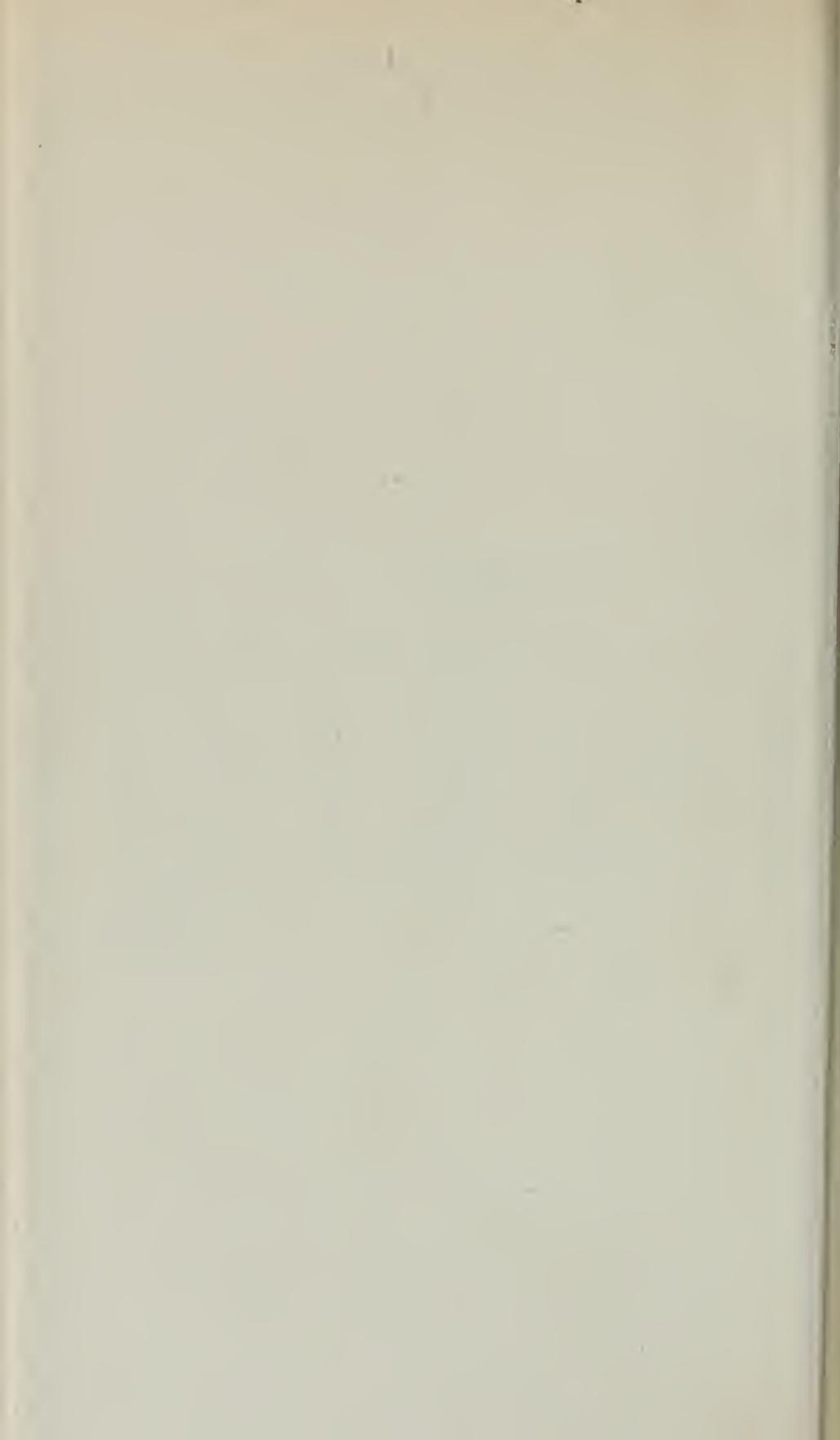
Exhibit No. 43.

ANY—MAGNA PLANT
L DEPARTMENT

s for Period—April 1st and 7, 1917—Inclusive

Ratio of Concent'n	Pounds New Oil Added	Lbs. Oil in Circu- lation	Excess Lbs. Cir- culating Oil	Total Lbs. Oil, New, Plus Excess	Pounds New Oil Per Ton	Pounds Circulat- ing Oil Per Ton	Lbs. Ex- cess Cir- culating Oil Per Ton	Total Lbs. Oil Per Ton, New, Plus Excess	Dry Tons Pulp in Circulation	Per Cent Solids	Total Lbs. Reagent	Lbs. Reagent Per Ton
3.76	5666			5666	5.16			5.16		37.99	3595	3.27
4.40	4418	354	99	4517	4.07	.33	.09	4.16	51	35.93	3404	3.13
3.90	18450	3310	1430	19880	16.85	3.02	1.31	18.16	94	32.20	3396	3.10
4.19	19527	5019	2959	22486	17.91	4.60	2.71	20.62	103	32.92	2922	2.68
3.99	21499	4010	1430	22929	19.47	3.63	1.30	20.77	129	30.41	3803	3.44
4.32	21829	5177	2617	24446	20.27	4.81	2.43	22.70	128	27.93	4275	3.97
4.16	21012	2948	1068	22080	20.22	2.83	1.03	21.25	94	27.51	4628	4.45
	112401	20818	9603	122004					599		26023	
4.089	16057	2974	1372	17429	14.811	2.743	1.265	16.076	86	32.165	3718	3.429

R. A. CONRADS,
Metallurgical Engineer.



Defendant's Exhibit No. 44.

RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT
FLOTATION OPERATIONS
Retreating Vanner Concentrate Products

PERIOD	FLOT. HEADS		FLOT. CONCTS.		Tails		Flotation		New Oils		Oil Assays	
	Tons	Assay % Cu.	Tons	Assay % Cu.	Assay % Cu.	Assay % Cu.	Copper Appr. %	Recovery Estim. %	Lbs. Per Ton	Lbs. Per Ton	Flotation Heads Including Circul. Load	Percents Concts. Tails
1914												
4th Quarter	8821	6.87	1892	29.78	.617		92.94	92.94	4.31			
1915												
1st Quarter	17849	6.42	3752	28.94	.425		94.76	94.76	3.47			
2nd Quarter	8802	5.60	1702	27.33	.397		94.28	94.28	5.28			
3rd Quarter	17328	5.73	3797	24.17	.554		92.45	92.45	4.92			
4th Quarter	19558	6.12	4200	26.44	.574		92.64	92.63	4.42			
YEAR	63537	6.029	13451	26.61	.502		93.439	93.436	4.41			
1916												
1st Quarter	20190	4.967	3629	25.37	.496		91.80	91.80	3.34			
2nd Quarter	22750	5.460	4302	26.62	.441		93.47	93.47	3.23			
3rd Quarter	22750	5.840	4767	26.59	.316		95.73	95.73	3.22			
4th Quarter	27275	6.099	6086	26.38	.273		96.52	96.52	3.54			
YEAR	92965	5.630	18864	26.30	.375		94.69	94.69	3.36			
1917												
January	9300	6.24	2267	23.99	.456		94.48	94.48	20.02	1.07	2.87	.10
February	8550	6.63	2289	23.63	.422		95.33	95.33	18.77	.97	3.15	.033
March	11063	6.70	3377	21.07	.368		96.19	96.19	21.19	1.01	3.03	.062
1st Quarter Average	28913	6.531	7933	22.76	.412		95.42	95.42	20.10			

(Signed) E. W. ENGELMANN,
 Flotation Foreman.

Hayden 3/29/1917
 Copied Butte 4/15/1917

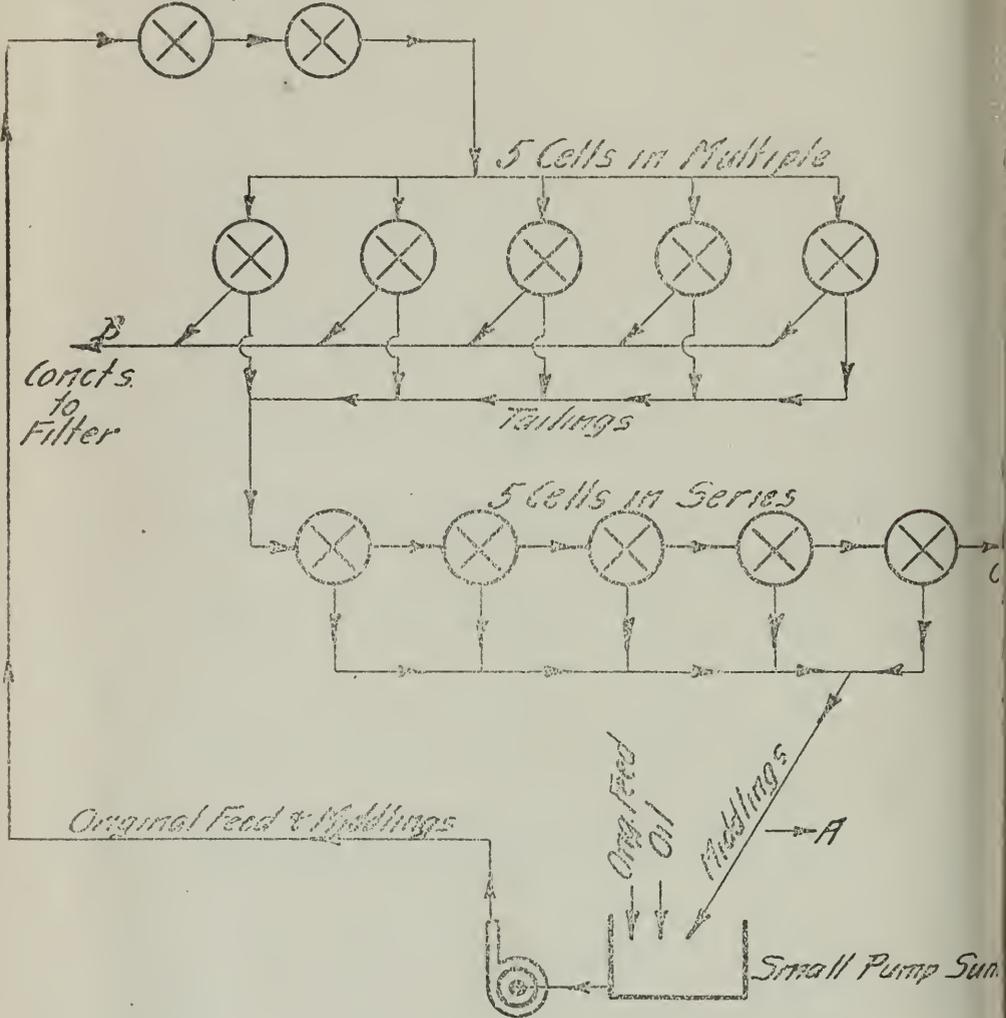
Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.

Defendant's Exhibit No. 45.

RETREATING MACHINE-MECHANICAL AGITATION
JANNEY TYPE

Two Emulsifiers in Series



Enlemann April 20-

Plaintiffs' Exhibit No. 46.

DISCLAIMER

835,120—Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard, and John Ballot, London, England. ORE CONCENTRATION. Patent dated November 6, 1906. Disclaimer filed March 28, 1917, by the assignee, Minerals Separation, Limited.

“Your petitioner, therefore, for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your petitioner does not choose to claim or hold by virtue of said Letters Patent No. 835,120, does hereby disclaim from claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore.”

(Official Gazette, April 3, 1917.)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 47.

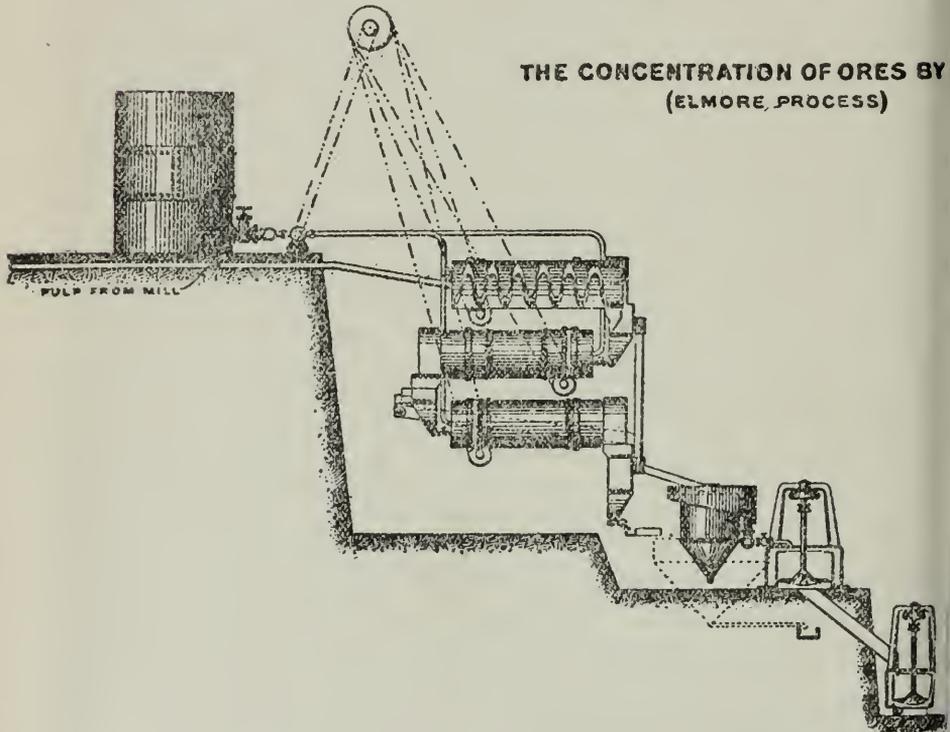
From the California Journal of Technology, November, 1903.

**EXPERIMENTS ON THE ELMORE PROCESS
OF OIL CONCENTRATION**

By W. F. Copeland, Min., '03, Drury Butler, Min., '03,
Jas. H. Wise, Min., '03.

Inasmuch as the fundamental ideas underlying the Elmore Process of Oil Concentration are comparatively new, a brief outline of the process as it is in actual operation will first be given.

The process depends upon the fact that minerals



with a metallic lustre, when treated in the form of a wetted pulp, adhere to oil, while earthy minerals do not. Two distinct operations are involved; first the separation of the metallic mineral from the gangue

Defendant's Exhibit No. 47.

by means of the oil; second the extraction of the mineral from the oil.

The ideas underlying the first operation were patented by John Turnbridge of Newark, N. J., in 1878. In 1886 Carrie J. Everson, of Chicago, contributed the idea that the concentration was aided by the presence of an acid solution, and patented the same. But the absence of a successful method of separating the mineral from the oil prevented the practical application of these early patents. Burning the oil was tried, but this left a difficult residue to treat, and the large consumption of oil made the method too expensive. Settling the mineral out by thinning the oil with gasoline, ethers, carbon bisulphide, etc., also proved too expensive, and it was not until July, 1900, that this difficulty was overcome, when Mr. Francis E. Elmore, of Leeds, England, accomplished the separation by means of a centrifugal machine, similar in most respects to those used in sugar factories and in milk and cream separation. This contribution by Mr. Elmore, then, made the process feasible.

The plant, designed by the Oil Concentration Syndicate, and now in successful operation, is shown in the accompanying cut. This plant consists of oil supply tank, long horizontally rotating cylinders, each containing a fixed helical screw inside, separating devices at the end of each cylinder, receiving tanks for mineral laden oil, centrifugal separators, pumps, etc.

The pulp and oil are charged into cylinder No. 1, at "A," simultaneously. By slowly rotating the cyl-

Defendant's Exhibit No. 47.

Under the pulp and oil are brought into thorough contact and carried forward at the same time. From cylinder No. 1 the material is continually discharging into separator No. 1. (These separators are Spitzkasten or hydraulic separators.) Here the mineral laden oil is floated off. The tailings are drawn off at the bottom of the separator and charged into cylinder No. 2 with more oil, and thus the treatment is repeated as many times as necessary, three usually being sufficient. From the last separator the tailings go to the tailings heap. The mineral laden oil collecting^{ed} from all the separators is carried to a large receiving tank "B." Here, after being heated in order to thin it and overcome its viscosity, the oil is charged into centrifugal machines, where the concentrates are separated out; the oil, freed from its load of mineral, is pumped back to the original storage tank to be used again.

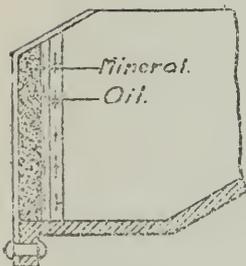


FIG. 1.

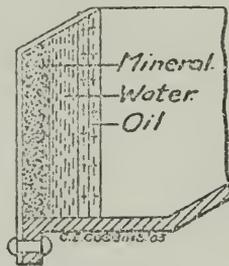


FIG. 2.

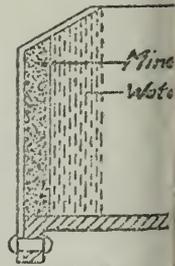


FIG. 3.

The oil commonly used is a heavy residuum of consistency of ordinary cylinder oil, with specific gravity about .9, and hence the maximum load it can carry and still float in water is from 100 to 200 lbs. per

Defendant's Exhibit No. 47.

ton. Usually about a ton of oil is kept in operation for each ton of ore, but the losses of oil are small, the recovered oil being used over and over again. With the treatment in the above mentioned plant it is claimed that the losses are not ^{or} greater than from one to three gallons of oil per ton of ore.

CENTRIFUGAL SEPARATOR (See Fig 4.)

The theory of the separator is illustrated in figures No. 1 to No. 3 inclusive. The oil laden with its mineral (heated to 100°-150° F.) is charged into the centrifugal basket. (C or B, Fig. 4.) When the basket is rotated at high speed (about 5000-6000 peripheral feet per minute) the charge arranges itself according to the specific gravities of the particles, the heavy ones seeking the periphery, as shown in Fig. 1. Water is then added, and this, due to its specific gravity, takes place between the oil and the mineral. Sufficient water is added to displace all the oil, which latter is discharged over the lip of the basket, and collected in a receiver.

If a small quantity of hot water precedes the charge of mineral laden oil, the mineral particles, on seeking the periphery, have to pass through the water and are thus more completely freed from the oil. This idea is illustrated in Fig. 3.

The concentrates are then dried in a second basket (1, Fig. 4) with porous periphery and filter bag. (E, Fig. 4.)

Defendant's Exhibit No. 47.

LABORATORY METHODS.

In making a test, the ore is first crushed to the desired fineness, and the proper charge is thoroughly wetted in the solution to be used (usually water), thus forming a thin pulp. The oil is next added and the whole charge thoroughly mixed. This mixing, or agitation, can be done in two different ways. The charge may be agitated very gently, the oil being kept in a single lake, and broken up as little as possible consistent with a thorough contact of pulp and oil; or the charge may be agitated ^{so violently} as to dash the oil

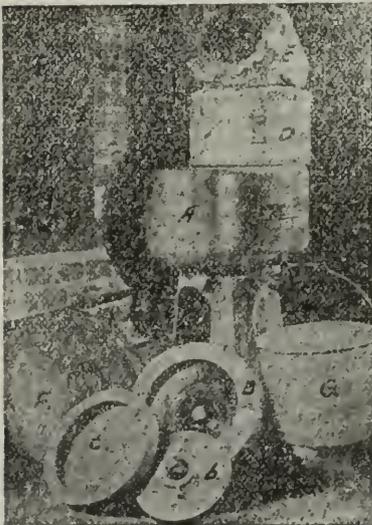


FIG. 4.

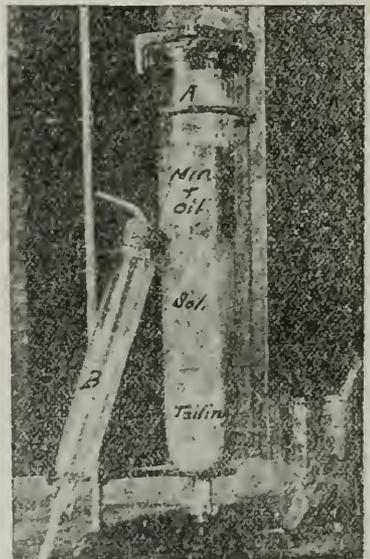


FIG. 5.

up into a foam or froth full of air bubbles; thus a very thorough contact of oil and pulp is obtained. Each method has its advantages and disadvantages, and these are discussed later.

Defendant's Exhibit No. 47.

At first the mixing was performed in a galvanized iron mixer. The mineral laden oil was then skimmed off with an aluminum ladle. (Aluminum, if thoroughly wetted, does not adhere to the oil. To wet the same thoroughly, first wash, then dip in strong sulphuric acid, and then wash in water.)

The roughness of the aluminum mixer and the affinity of the oil for the metallic surface makes a thorough clean-up after each test difficult, hence a large clean-up error is always introduced by this method.

Glass, however, behaves towards oil just as the non-metallic gangue does, (glassware is cleaned up and surface wetted the same as aluminum), and by the use of ordinary percolating tubes, such as shown in figure No. 5 (A and B), the clean-up error may be entirely eliminated. With these, the tailings may be drawn off at the bottom and oil at the top, as desired. Three methods of mixing may be used. 1, By inverting the tube several times, thus allowing the ore to fall through the oil. 2. By rotating the tube in a horizontal position, thus throwing the pulp up on to the surface of the lake of oil. 3. By violently shaking the tube, thus producing the foam effect, or at least shattering the oil into small globules. The charge having been thoroughly mixed, the tailings are allowed to settle, solution is added to float the oil to the top of the tube, whence it may be floated off as shown in figure No. 6.

Defendant's Exhibit No. 47.

The mineral laden oil is then heated and treated in the centrifugal separator as above described. For small tests, a shallow basket, such as is shown at C, in figure No 4, may be used.

The solution used in the concentration is a matter of some importance. Water is, of course, used whenever possible, but certain other solutions have important advantages. As before stated, an acid solution is found advantageous. It cleans the metallic surfaces, by dissolving the metallic oxide coatings that may have formed on them. It increases the specific gravity of the solution, and it aids in producing the foam effect which is due to the generation of certain gases.

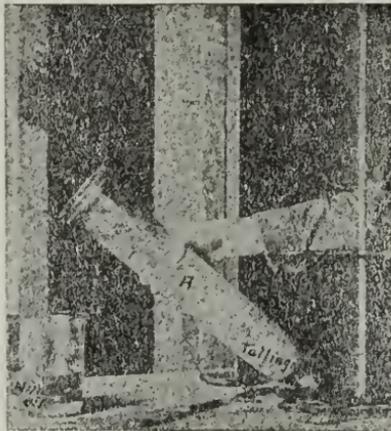


FIG. 6.

As before stated, the specific gravity of the average oil used is about .9 and water .1, leaving a difference of about .1 for buoyancy or carrying capacity of the oil. The idea at once suggests itself that if a denser solution be used, the carrying power of the oil will be increased correspondingly. A salt (NaCl) solution,

Defendant's Exhibit No. 47.

for instance, gives excellent results. A saturated solution of NaCl at 20° C, containing about 27% NaCl, has a specific gravity of 1.204. This gives a difference of .3 between the specific gravities of the oil and of the solution, and a carrying capacity of the oil three-fold greater than with water alone. Not only does it give a greater buoyancy to the oil, but it also aids materially in producing the foam effect, and probably aids in brightening the metallic surfaces.

The phenomena of overloading is so vital in the practical application of the process, as well as in the laboratory tests, that it must be thoroughly understood. With oil of specific gravity .9 the maximum possible load of mineral it can carry in water is 200 pounds per ton, while in a saturated salt solution it is 600 pounds per ton. If these limits are exceeded the oil is said to be overloaded and sinks. But it is not necessary that the whole mass of oil in any particular case be charged to this extent in order that overloading take place. If a charge of oil and mineral, safe within the above limits, be allowed to stand, the mineral will settle to the bottom of the oil, and hence in the lower portions of the oil the percentage of mineral may exceed the safe limits. In case the overloading is sufficient to overcome the surface tension of the oil, small masses separate away from the main mass and sink. It is evident, then, that the time allowed for the gangue to settle out of the oil should not be long enough to permit the overloading to take

Defendant's Exhibit No. 47.

place. Small globules of oil separated from the main mass in agitation may also become overloaded.

TESTS—MOLYBDENITE ORE.

The ore treated was low grade, with the values fairly well disseminated. The gangue minerals were orthoclase and quartz. Samples were crushed to 20, 30 and 40 mesh, and treated in percolating tubes as outlined above. The details and results are given in the following table:

MOLYBDENITE

No. of Exp.	Wt. Ore Treated	Mesh	Total amt. of Oil Used	No. of Treat.	Value Conc. % MoS ₂	Value Tails % MoS ₂	% of Extrac.
1	2 kg.	20	2400	4	23.9	.92	6.30
2	2 kg.	30	2400	3	23.2	.81	67.6
3	1 kg.	40	1200	3	17.4	.82	67.2
4	100 gms.	30	2.1	1	32.4	1.41	43.5
5	100 gms.	30	5.3	2	32.4	1.30	47.0
6	100 gms.	30	8.9	3	32.4	.62	75.0
7	.....	30	3.	1	47.9	.....	.....
8	.....	30	3.	3	27.6	.....	.....
9	.....	30	3.	1	50.0	.....	.....

Experiment No. 1 showed the presence of middlings, requiring finer crushing to liberate the sulphide. Experiments No. 2 and No. 3 gave practically the same percentage of extraction, but the concentrates in No. 3 were much lower grade than in No. 2. A comparison of values of concentrates in No. 1, No. 2 and No. 3 shows clearly that although the finer crushing has freed the MoS₂ from the gangue, at the same time it has produced a larger percentage of fine gangue which, becoming mechanically occluded in the oil, gives a low grade concentrate.

Defendant's Exhibit No. 47.

Experiments No. 4, No. 5 and No. 6 show the results obtained by treating separate samples with small quantities of oil, in a salt solution, and agitating violently to produce the foam effect. This method gives the highest grade concentrates of any of the direct treatments here outlined. In experiment No. 6 only about 10c.c. of oil was used for 100 grams of ore. This gave an extraction of 75% with concentrates running 32.4% MoS_2 .

But these concentrates were not marketable. In practice they would have to be reconcentrated. The results of a few reconcentration tests follow.

Samples of concentrates running about 26% MoS were agitated in a sulphuric acid solution 15 minutes. This agitation caused considerable of the occluded gangue to free itself. A small quantity of oil was then added and the material reconcentrated, utilizing the foam effect. In No. 9 a concentrate running 50.02 MoS_2 was obtained. Concentrates such as these would probably be marketable. In experiment No. 8 reconcentration was tried without the agitation in sulphuric acid solution, but the results were unsatisfactory.

The experiments on molybdenite ores are of interest because the sulphide of molybdenum has lately come into prominence in the manufacture of molybdenum steel, and also because of the fact that all previous methods of concentration other than hand sorting, have failed in its case.

Defendant's Exhibit No. 47.

COPPER ORES.

The ore treated was the raw product taken directly from a mine in Calaveras County, near Copperopolis. It consisted of chalcopyrite, bornite and pyrite, with a chlorite and amphibolite schist gangue. The copper values were contained in the chalcopyrite and bonite.

A 6 Kg. charge of the ore, previously ground to 40 mesh, was jigged to remove the coarse material; the products being heads, middlings and tails. 1.2 Kg. of the jig tailings was given the following treatment. The charge was thoroughly mixed and wetted in a large percolating tube with about 700 ccs. of water; 5000 ccs. of oil were then added and the whole was gently agitated for 20 minutes. After standing for several minutes the mineral laden oil was floated off, warmed, run through the separator and parted as previously explained. A careful assay of the different products shows the following very satisfactory results:

	Weight.	% Cu.	Cu. Content.	% Extrac.
Ore	6000 gms	2.73	163.8 gms	
Wet { Heads	575 gms	4.88	28.05 gms	16.7
Conc'n. { Mids	800 gms	4.66	37.23 gms	22.3
{ Tails	4625 gms	2.19	101.28 gms	60.8
Oil Conc	175 gms	13.05	22.83 gms	90.8
Oil Tails	1025 gms	.23	2.35 gms	9.3

From the above table it is readily seen that over 60% of the copper content lies in the jig tailings, and of this 90% can be extracted by the oil concentration method, with a ratio of concentration of 7:1.

Summarizing the above facts it is seen that by

Defendant's Exhibit No. 47.

means of the oil concentration method a total (i. e. including jig heads and middlings, and oil concentrates) of 94.2% of the copper in the raw products is recovered, and the bulk of the material containing this copper is but 25.8% of the original ore charge taken.

GOLD ORES.

1. *Auriferous Black Sands.*—Before treating a sample of the auriferous sand, separate samples of the black sand and of free gold were tested to determine the relative affinity of the oil for each.

(a) Magnetic black sands from Cape Mendocino, consisting of magnetite with some quartz and pyrite, were run through a magnetic separator to separate out the magnetite. The latter was treated with oil and, contrary to expectations, the oil, when cold, united readily with the black sand, but dropped it on being warmed. Black sands from Nevada County Hydraulic Mines were treated in the same way, but in this case the black sand showed very little affinity for the oil.

(b) A sample of very fine flour gold from Klondyke undercurrents was next treated. When cold and viscous the oil took up the gold very readily, but on being warmed dropped most of it, just as in the case of the Mendocino black sands.

A sample of rusty flake gold obtained from the Nevada county black sands by panning was next tested with water and oil as above. The oil showed

Defendant's Exhibit No. 47.

very little affinity for the gold in this condition, and the few flakes that were picked up soon dropped. In order to brighten the flakes and remove the rust, a dilute solution of sulphuric acid was used in place of water, but again the gold was only partly taken up by the oil. A dilute solution of potassium cyanide was next tried on a fresh sample of the gold flakes, but no improvement was noticed. The flakes were next lightly coated with mercury and in this condition they were readily taken up by the oil.

(c) A test was made upon mercury to see how the oil would act upon it. When in the condition of coarse globules, the mercury was not taken up by the oil. Upon violent agitation, however, the mercury floured, and in this condition was readily picked up by the oil. The tendency toward overloading the oil was strong on account of the high specific gravity of the mercury, and much oil had to be used.

2. *Quartz Gold Ores.*—(a) A representative sample of unoxidized mother lode ore was obtained from Tuolumne county. About 75% of the values were in the sulphurets, as shown by amalgamation and concentration at the mine. The ore, crushed to 40 mesh, was treated in a ½% sulphuric acid solution ^{with oil} in the ratio of 1000 ccs. of oil per kilo of ore. Owing to lack of facilities at the mine, where these tests were made, the concentrates could not be separated from the oil, hence the extraction was determined by the method of difference.

Defendant's Exhibit No. 47.

TUOLUMNE ORE.

The original ore assayed gold.....	\$2.26 per ton
The tailings assayed .....	.31 per ton

Extraction1.95 per ton
 or 86.28% of original assay value of ore. This compares favorably
 with the total average extraction of 80% to 90% obtained by
 amalgamation and concentration at the mine.

(b) Two samples of ore were received from a mine near Folsom, Cal. The ore consisted of quartz with a small percentage of pyrite and chalcopyrite and some free gold. The sulphurets were badly oxidized. The treatment and results obtained are shown in the table following:

FOLSOM ORE.

Mesh.	Wt. Ore.	Vol. Oil. cc.	Wt. Conc.	Value Ore.	Value Conc.	Tails.	% of Extrac.
30	500 gm	500	24	\$21.50	\$105.80	\$11.57	23.6
30	500 gm	500	58	21.50	151.36	8.46	81.7
50	500 gm	500	52.5	21.50	157.00	7.86	76.6
50	500 gm	500	48.5	21.50	185.08	3.52	83.7
30	1000 gm	1000	20.5	39.50	527.50	17.45	27.4
60	100 gm	100	10	31.50	240.00	12.00	60.7
80	100 gm	100	12	39.50	255.00	9.40	77.5

No. of treatments in each case, 3.

Solution used in Nos. 1, 3, 5, 6, 7, was water; in Nos. 2 and 4 it was 1% H₂SO₄.

Weight tails=weight ore—weight concentrates.

(c) A sample of gold ore from Tuolumne County, Cal., containing quartz, molybdenite, pyrite and some telluride and free gold was treated. The presence of molybdenite made amalgamation very difficult. The sample, crushed to 30 mesh and treated in water with oil, gave the following extraction:

Ore Wt.	Val. Ore.	Wt. Conc.	Val. Conc.	Wt. Tails.	Val. Tails.	Ratio Conc.	% Ex.
46 gm	\$32.70	4.1	\$140.26	41.2	\$16.40	9.4:1	55.2

Defendant's Exhibit No. 47.

Silver Ores.—A small test was made on a sample of Ruby silver ore from Tonopah. The silver values consisted of proustite, pyrargyrite and some horn silver.

The original ore assayed gold.....	\$ 162.25
Silver	259.82
	\$ 422.07
The sample was concentrated in a 20% NaCl solution yielding tails which assayed gold.....	36.17
Silver	73.12
	\$ 109.29
The oil concentrates assayed gold	\$ 547.75
Silver	1092.25
	\$1640.00 per ton

Although the tailings were high, yet 80% of the gold and 75% of the silver was extracted. Further investigation would probably show an improvement over these results.

RESUME.

As a conclusion to the above experiments the following suggestions and inferences are appended:

1. *As Regards the Wetted Pulp.*—As far as could be determined particles with either metallic or non-metallic surfaces when in the dry state, alike adhere to the oil. Furthermore, there is no affinity of oil for water as is shown by the fact that an oiled surface cannot be wetted. Hence if a metallic particle be thoroughly wetted, a water surface and not a metallic surface is exposed to the oil, and the former, as before stated, has no affinity for the oil. It is evident then that the water film must first be

Defendant's Exhibit No. 47.

displaced before the oil and mineral can come in contact with each other. This displacement is hardly probable if the water film is in intimate contact with the particle, and it seems more probable that the differentiation is due to the fact that non-metallic surfaces are, and metallic surfaces are not actually wetted. If this be the case, a careful study of the relative wetting of different surfaces would be an important line of investigation.

2. The ratio of the exposed surface to the weight of the particle should be as large as possible, because the total adhesive force is increased with an increase of the surface exposed to contact with the oil. This condition is best realized when the mineral breaks up into thin flakes. It is evident from this that a knowledge of the fissile character of the minerals in question is important.

3. One fundamental difficulty involved in this process is that it undertakes to concentrate and float a heavy metallic mineral, and sink the lighter gangue minerals, but this point is not necessarily fatal to the process. It is evident, however, that the heavier the gangue and the lighter and more fissile the metallic minerals, the better the ore is adapted to this method of concentration. This is a direct reversal of the ideal conditions for jig or vanner concentration.

4. Another characteristic of the process is the fact that the ratio of concentration is usually small, due to the large amount of gangue occluded by the oil and carried into the concentrates. This difficulty

Defendant's Exhibit No. 47.

is increased by sliming the gangue minerals. Sliming of the metallic minerals is no disadvantage.

Foam Effect.—The foam effect is produced by a violent agitation, especially in acid or salt solutions. This throws the oil into a froth, which is heavily charged with air or gases. This gas of course gives a greatly increased buoyant force. The oil in this condition assumes a certain load of mineral and holds it in a very stable condition. The charge does not settle and overload on standing as in the case of the lake effect. The foam effect is best adapted for light, flaky minerals, such as molybdenite.

The work above outlined suggests many lines of further investigation, and as these come to be worked out, the process will become more valuable and of more general application.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

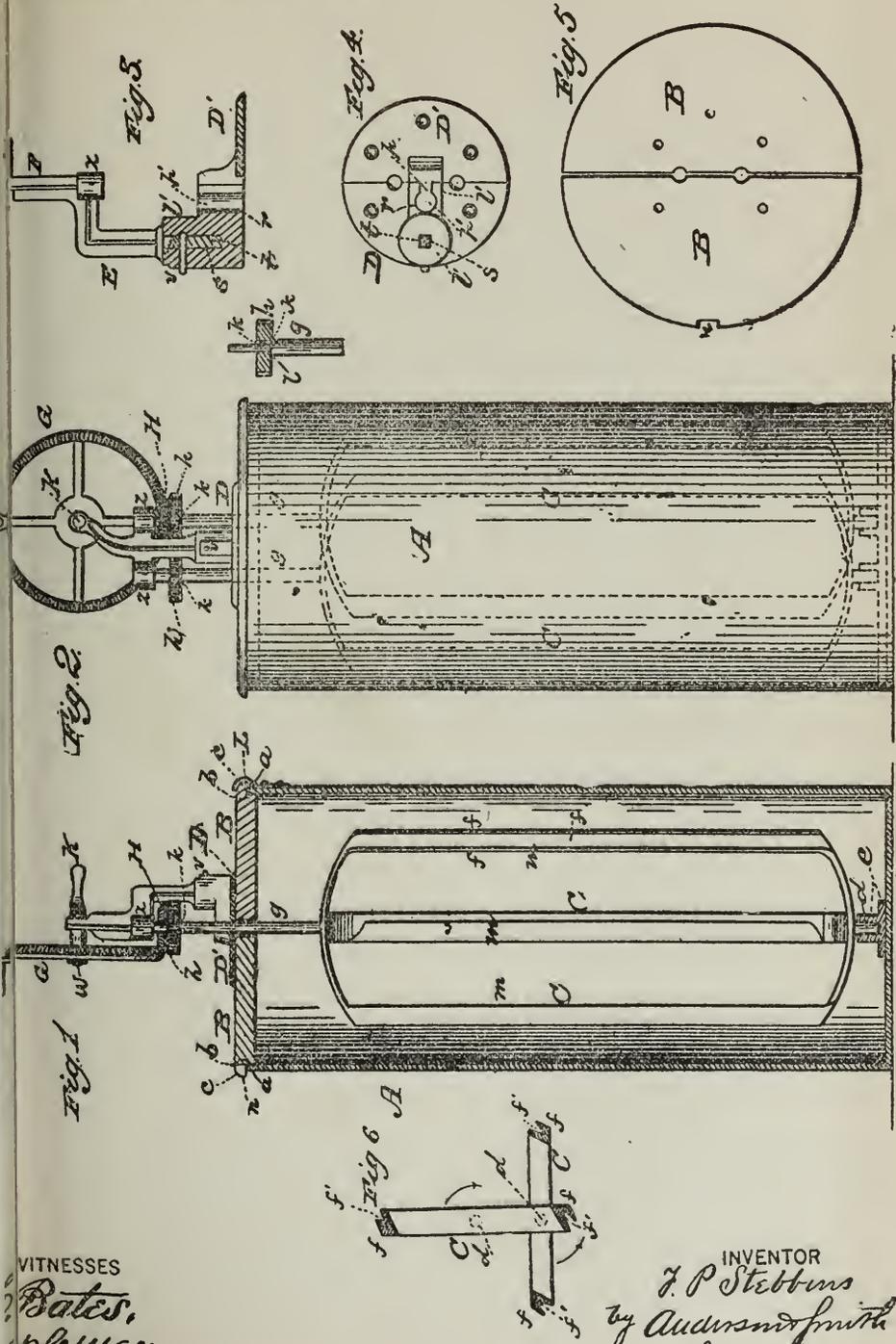
By H. H. WALKER, Deputy.

CHURN.

N. 266,219.

Patented Oct. 17, 1882.

Exhibitor's Exhibit No. 48.



WITNESSES
 Bates,
 & Thomas

INVENTOR
 F. P. Stebbins
 by Anderson & Smith
 his

UNITED STATES PATENT OFFICE.

FRANK P. STEBBINS, OF DETROIT, MICHIGAN.

CHURN.

SPECIFICATION forming part of Letters Patent No. 266,219, dated October 17, 1882.

Application filed May 13, 1882. (No model.)

To all whom it may concern:

Be it known that I, FRANK P. STEBBINS, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a new and valuable improvement in Churns; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawings is a representation of a vertical sectional view of my churn and freezer. Fig. 2 is a side view of the same, and Figs. 3, 4, 5, and 6 are detail views.

This invention has relation to churns and cream-freezers; and it consists in the construction and novel arrangement of the studded catches for the lid-sections, the separable arm or support for the drive-wheel, and its double bearing for the upper ends of the dasher-stems, the plate-sections for the lid-sections, and the socket-and-tongue connection with which they are provided, all as hereinafter set forth.

In the accompanying drawings, the letter A designates the case, which is of ordinary upright form, having a circular area in horizontal section.

B B indicate the cover-sections, each being semicircular and marginally rabbeted at *a* to form a lip, *b*, which fits within the mouth of the case, and a marginal rim-flange, *c*, which projects outward over the edge of the case.

C C represent the dashers, which are made in loop form, being cast of metal. The lower end of each loop-dasher is formed with a supporting-stem, *d*, which works in a pivot-bearing, *e*, at the bottom of the case. The upper end of each loop-dasher is formed with a vertical stem, *g*, which extends upward through a bearing at the joint of the cover-sections, and is provided with a pinion, *h*, as indicated in the drawings. The pinion is secured on the stem by means of a spline, *k*, which is cast on the stem, so that, while it is fast thereto for all purposes of communicating rotary motion, it can be easily and quickly removed. Each stem is cast with a shoulder, *l*, below the spline, on which the pinion rests. The side bars, *m*, of each loop-dasher are cast with oblique longi-

tudinal flanges *f* on their outer edges, flanges being turned in opposite direction the side bars; so that the V-form channels which lie between the flanges and the bars, will face or open in opposite directions as shown. The object of these channels is to aerate the milk or cream as the loops are turned. The stems of these dashers are placed sufficiently close together to allow each in its rotary movement, to intersect the path of the other without interference.

D D' represent the semicircular plate-sections, which are respectively secured to the upper surfaces of the cover-sections at middle and adjacent portions, so as to form a bearing when closed together, an iron bearing *v* is concentric with the periphery of the cover-section. The plate *D'* is formed with a lug at its outer end, carrying a projection, *p*, which extends to the joint of the meeting edges of the two sections, and is enlarged at its outer end, as indicated at *p'*, forming a coupling-tongue to engage a slotted socket-recess, *r*, of corresponding form, which is made in a large lug, *l'*, on the top of the other plate-section, *D*. The lug *l'* is also formed with a square socket extending downward into its upper portion, which is designed to receive the squared end of the double bearing-arm *E*. A pin, *s*, passing through registering-perforations in the socket *s* and tang *t*, serves to secure the arm in its seat in such a manner that, while it is perfectly secure; it can be easily removed. The arm *E* is formed with two lateral bearing-arms in which the upper ends or journals of the stems *g* of the dashers are seated, and an upward and lateral extension, *F*, carrying a transverse bearing, *w*, for the driving wheel *G*, which engages a bevel-pinion, *o*, on the stem *g*, over which the laterally-projecting bearing *w* is situated, as indicated in the drawings.

K represents a transverse handle on the extension *F*, in rear of the bearing *w*, which is designed to enable the operator to steady the machine with one hand while turning the handle of the drive-wheel with the other. The construction is designed to form a strong and compact support for the gearing and dasher-stems, whereby the driving mechanism is maintained in proper position when the cover-

is in place and duly connected by the
 and socket of their iron plates, and
 F is fastened in its seat, and it per-
 ready removal of the driving mech-
 when the case is to be opened. In this
 the pin *v* is drawn out of the socket
 and the arm E, with the drive-wheel, is lifted
 id socket. The pinions can then bere-
 from the dasher-stems, if necessary.

nder to secure the cover firmly to the
 ll, the latter is provided with the edge-
 ke, which are fastened by studs or rivets
 wall, and, projecting by their heads
 ve the same, serve to engage the rim-flanges
 the cover-sections, one of which is formed
 h edge-notch, *n*, to facilitate the engage-

ing described this invention, what I
 and desire to secure by Letters Patent,

the cover-plates D D', having a tongue-
 socket connection, and a separable arm,
 for the drive-wheel, carrying a double bear-

ing for the upper ends of the stems of the
 dashers, substantially as specified. 25

2. The cover-sections having the plate-sections
 D D', connected by tongue *p'* and socket
r, and the edge-hooks L of the wall engagin-
 the rim-flanges *c* of the cover-sections, s-
 substantially as specified. 30

3. The combination, with the dashers C,
 having the splined and shouldered stems *g*,
 and their pinions *h* H and the drive-wheel G,
 of the cover-sections B, plate-sections D D',
 their socket-and-tongue connection, the socket 35
s, pin *v*, and removable arm E, having the
 lateral bearings *z*, and the extension F, sub-
 stantially as specified.

In testimony that I claim the above I have
 hereunto subscribed my name in the presence 40
 of two witnesses.

FRANK PIERCE STEBBINS.

Witnesses:

LOUIS F. GUENTHER,
 ADAM E. BLOODE.

W. H. SPROULE, Clerk.

By H. H. WALKER, Deputy.

S. J. SULLIVAN

CHURN.

No. 306,441.

Patented Oct. 14, 1884.

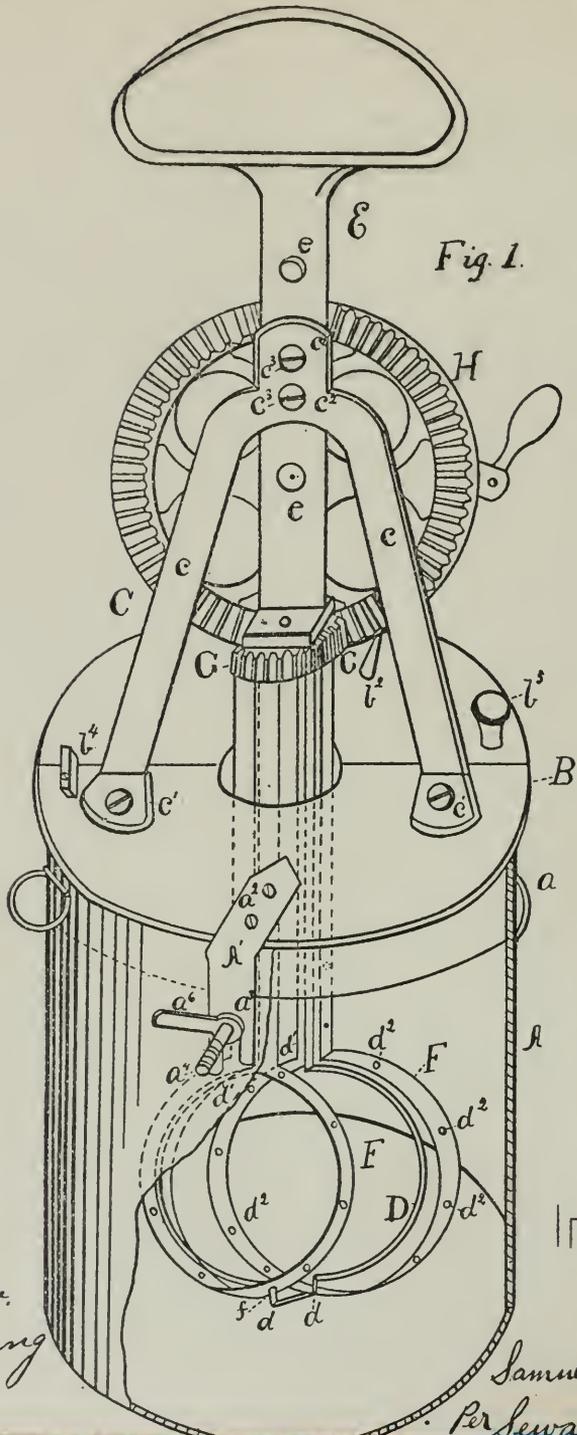


Fig. 1.

Witnesses.

G A Haseltine.
Henry C Young

Inventor

Samuel J. Sullivan
Per Seward A. Hazard

S. J. SULLIVAN.

CHURN.

2 Sheets—Sheet 2

No. 306,441.

Patented Oct. 14, 1884.

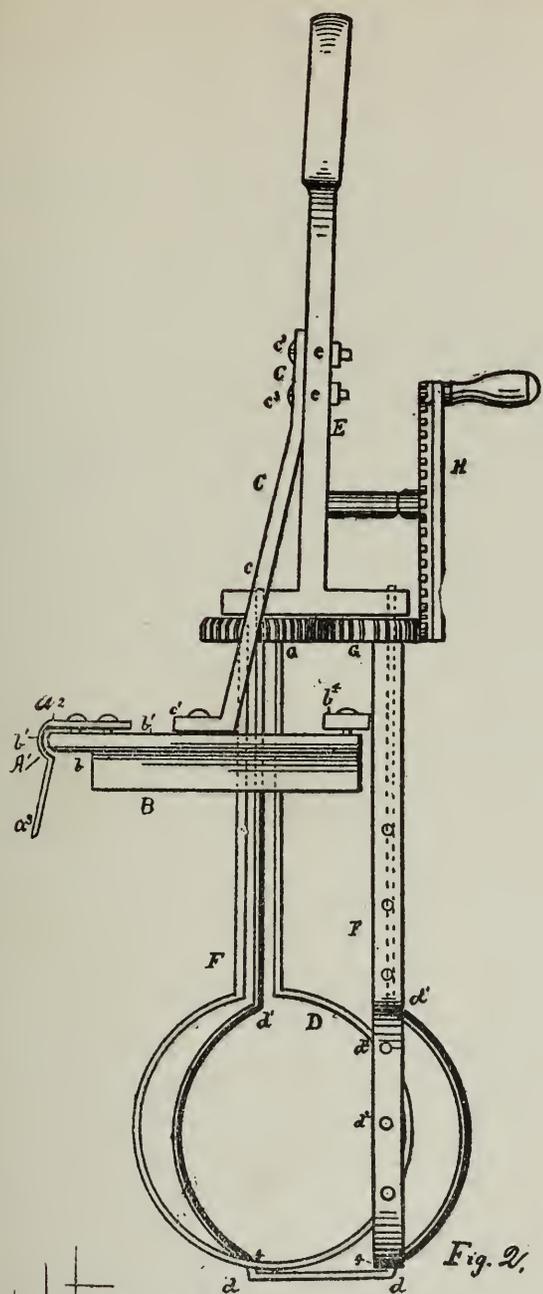


Fig. 2.

Witnesses.

G. A. Haseltine.
N. A. Haseltine

Inventor

Samuel J. Sullivan
By Seward A. Haseltine:
Attorney

UNITED STATES PATENT OFFICE.

SAMUEL J. SULLIVAN, OF LAMAR, MISSOURI.

CHURN

SPECIFICATION forming part of Letters Patent No. 306,441, dated October 14, 1884

Application filed October 29, 1883. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL J. SULLIVAN, a citizen of the United States, residing at Lamar, in the county of Barton and State of Missouri, have invented certain new and useful Improvements in Churns, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in churns, the object of which is to provide an easy, convenient, and rapid means of churning and obtaining butter from cream, and also to provide a churn that is easily cleaned, and one simple in its construction and operation, and adapted to be used in earthen or other vessels. I attain these objects by means of the device illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a view in elevation showing the entire device, a part of the vessel being removed. Fig. 2 is a view showing the parallel dashers and adjustable support.

Similar letters of reference indicate corresponding parts in all the figures.

A is a vessel made of wood, tin, stone, earthen or other suitable material and of any convenient size and shape, preferably made of wood, cylindrical in shape, and with suitable ears or handles, *a a*, for moving the churn.

B is a thick cover, preferably made of wood with a groove or rabbet, *b*, to fit closely in the top of the vessel A, the flange *b'* being projected over the edges. The cover is made with a hole in the center, and it is divided in two parts to facilitate its removal and the better to clean the dashers passing through it.

b' is a hook or latch, to hold the cover firmly to its place. The latch or latches may be upon either one or both sides.

In using an earthen vessel, I put a strap or band, *b*, around the top, to which the hooks are attached. On wood or metal vessels I use an attachment, *A'*, consisting of a piece, *a'*, firmly attached to the cover and extending over the flange, thence down, forming a fork, *a'*, which passes on each side of a bolt, *a'*, the said bolt being firmly attached to or through the vessel, and having a nut, *a''*, with a thumb-

piece for tightening the same, and thus firmly holding the supporting part of the cover to its position.

b' is a button to swing across the place where the cover divides.

b' is a knob used in raising one part of the cover.

C is a support having two spreading braces *c c*, both attached to one and the same part of the cover by foot-pieces *c' c'*, and an upper portion made with holes *c' c'*, in which are placed thumb-screws or set-screws *c' c'*, to firmly hold and adjust the dashers.

The dashers F F are constructed and operated somewhat similar to the common egg beater, which I change and modify for use in connection with the novel devices above explained, for the objects hereinafter more fully set forth.

The dashers are constructed and placed in the vessel as follows: A strong metallic rod D, is bent each side of and near the middle so as to form two right angles, *d d*, for bearings for the dashers. The ends are then turned upward and inward until they form nearly a complete circle, and at points *d' d'*, opposite to the points *d d*, the ends are bent vertically and parallel until they reach up through the cover and terminate in a handle, E. The dasher are made of thin perforated metal, and bent in similar form as the rod D, and have their upper ends attached in pinions G G. Holes are made in the middle of the lower part of each dasher, through which one end of the supporting-rod D passes until the bearings of the dashers are formed at *d d*. The pinions G G have bearings on the upper part of the rod D, and are operated by a gear-wheel, H. The gear-wheel has bearings on an arm of the handle E, and operates directly upon one of the pinion-wheels which operates upon the other. Thus geared, the dashers turn in opposite directions, and the circular part of each dasher being constructed so as nearly to fill the diameter of the vessel in which it is to be used and to intersect each others tracks without interference, I make the parallel parts of each dasher close together, so that the air is sucked down between them by the rapid rotary mo-

of the circular part and thus the entire
 is aerated. This process of distributing
 through the cream is assisted by the per-
 forations *d*, by which I have obtained butter
 in minutes, and herein is one of the great
 advantages of my invention. In the handle
 I make holes *e e e* for attaching it to the sup-
 port, the rod *D* being attached to the han-
 dle. When the handle is raised, one-half of
 the cover and everything in the vessel may be
 raised, thus leaving it easy to wash the ves-
 sel without having holes or cleats in the bottom to
 make it difficult to clean as heretofore in ro-
 tary dash-churns, and herein is another ad-
 vantage of my invention. The circular part
 of the dashers *I* I place beneath the cream by
 means of the thumb-screws on the support *C*,
 to enter the holes *e e*, thus permitting the
 dashers to be raised or lowered, as
 desired. This permits the parallel parts of
 the dashers to enter the surface and thus pre-
 vents all splashing and throwing of the cream
 during churning, and herein is another great
 advantage of the parallel and adjustable con-
 struction of my invention.

Having thus described the use, construction,
 and operation of my invention, I am aware
 that it is not new to provide a churn with ro-
 tary dashers, or to have such dashers per-
 forated, or to have the lower parts made round-
 ing and propelled by gear-wheels. I do not, 30
 therefore, claim such construction broadly;
 but

What I claim as new, and desire to secure by
 Letters Patent, is— 35

The combination of a vessel, *A*, severable
 cover *B*, slotted attachment *A'*, support *C*, se-
 cured to one side of the said cover, adjustable
 handle *E*, rod *D*, drive-wheel *H*, pinions *G G*,
 and perforated rotary dashers *F F*, having cir-
 cular bottoms and rods placed parallel and 40
 close together the better to agitate and force
 air into the cream, substantially as shown and
 described, for the purpose set forth.

In testimony whereof I affix my signature in 45
 presence of two witnesses.

SAMUEL J. SULLIVAN.

Witnesses:

JOSEPH S. MCBRIDE,
 J. P. FROW.

July 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.

Defendant's Exhibit No. 50.

Die
trocknenden Öle

ihre

Eigenschaften, Zusammensetzung und Veränderungen

sowie

Fabrikation der Firnisse aus denselben zu Anstrichen
 und für Buchdrucker, genaue Darstellung der Fabrikation aller
 Anstrich-, Buchdruck-, Stein- und Kupferdruckfarben.

Ein Handbuch

für

Lack-, Firniß- und Farbenfabrikanten, Kaufleute, Anstreicher,
 Lackirer, Maler u. s. w.,

nach dem

neuesten Stande dieser Industriezweige, unter Benutzung der hervortragendsten
 Literatur und nach eigenen vieljährigen Erfahrungen dargestellt

von

Louis Edgar Andés,

Lack- und Firniß-Fabrikant in Wien

Mit 49 in den Text eingedruckten Holzsichen

Braunschweig,

Druck und Verlag von Friedrich Vieweg und Sohn

1882.

Reinigung.

steht auf dem oberen Boden und enthält zwei durchbohrte Böden, durch welche es in drei Abtheilungen zerlegt ist. Die untere derselben steht durch ein kurzes knieförmig gebogenes Rohr mit dem Delbehälter in Verbindung, während die mittlere mit gröblich gepulverter Kohle, Baumwolle, Filz u. dergl. gefüllt wird. Die obere Abtheilung dient zum Ansammeln des filtrirten Deles und ist mit einem Hahne zum Abziehen desselben versehen. Fig. 5 zeigt die Einrichtung. Sind die Cistern mit Wasser und der Behälter mit Del gefüllt, so öffnet man die Röhre; das Wasser tritt nun in den Delbehälter und nimmt in demselben in Folge seiner Schwere den unteren Raum ein, während das Del durch die eine Röhre in das Filter steigt und durch den hydrostatischen Druck der in der anderen Röhre enthaltenen Wassersäule durch das Filter getrieben wird. Wenn sich nach fortgesetzter Arbeit in dem unteren Raum des Filters ein schleimiger Absatz aus dem Dele sammelt, so läßt man diesen durch den Hahn ab. Man het es auf diese Weise in seiner Gewalt, das klare Del schnell von dem Bodensatz zu trennen.

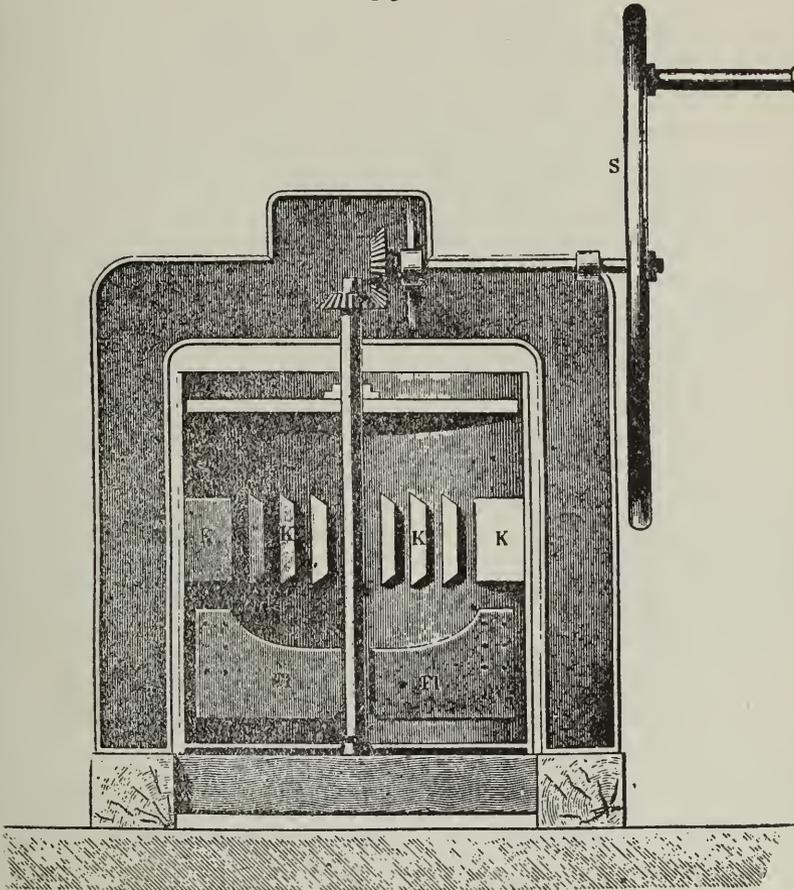
Ein anderes Verfahren ist folgendes: Man bringt das zu reinigende Del in eine, einem Drehbutterfasse gleichende Tonne, in deren Innerem sich eine mit Flügeln versehene Welle befindet, die durch eine Kurbel in Bewegung gebracht wird. Zu dem Dele gießt man das zweifache Volum reines Flußwasser, in dem etwas Kochsalz aufgelöst wurde. Nachdem die Tonne geschlossen worden, bringt man die Mischung eine volle Stunde lang durch Umdrehen der Welle in Bewegung. Je schneller dieses Umdrehen geschieht, um so mehr wird für die Reinigung des Deles gesorgt. Man öffnet nun die Tonne und gießt das Ganze in einen Kübel, an dessen Seite ein Hahn in solcher Höhe angebracht ist, daß das nach einiger Ruhe über das Wasser tretende Del rein durch denselben abgelassen werden kann. Nachdem man das Del nun 24 Stunden der Ruhe überlassen hat, wird das Del abgelassen und wieder in die Tonne gebracht, um mit ebensoviel Wasser als vorher abermals durcheinander geschlagen zu werden. In dem in dem Kübel zurückgebliebenen Wasser findet man einen bedeutenden Bodensatz, der durch den von dem Dele getrennten sogenannten Schleim gebildet worden ist. In neuerer Zeit sucht man Dele zum Zwecke der Firnißfabrikation auch auf mechanischem Wege mittelst Maschinen zu reinigen; bei diesen wird das Del in heftige Bewegung versetzt und mit der Luft in innige Berührung gebracht, damit sich die Unreinigkeiten leichter ausscheiden und dem Dele schon vor dem Kochen Sauerstoff zugeführt werde.

Die von der Actiengesellschaft für Maschinenbau und Eisenindustrie zu Bavel an der Zahde im Großherzogthume Oldenburg neuerdings gebaute Kataractmaschine scheint dazu berufen, alle anderen Maschinen, welche man bis jetzt zur rascheren Reinigung des Deles verwendete, zu verdrängen, und verdient dieselbe Eingang in alle Firniß- und Lackfabriken. Fig. 6 (a. f. S.) zeigt einen Vertikalschnitt durch die Maschine. Das zu reinigende Del wird bis zu einer Marke in das eiserne cylindrische Faß gegeben. Beim Drehen am Schwungrad S wird der Flügel *FL* in rasche Umdrehung versetzt; das Del steigt in Folge der Wirkung der Centrifugalkraft an den Wänden des Fasses in die Höhe, wird durch die Klappen *KK* und einem darüber liegenden Ring abgelenkt und stürzt in der Mitte zusammen; das Del macht also einen Kreislauf, und während dieses Kreislaufes findet ein so intensives Mischen und eine so heftige

Leinöl.

Bewegung und dabei eine so innige Berührung mit der atmosphärischen Luft statt, wie es durch keine andere Maschine und auf keine andere Weise erreicht werden kann. Deshalb eignet sich die Maschine auch so sehr gut zur Reinigung des Oeles

Fig. 6.



Kataractmaschine zur Oelreinigung.

und kann außerdem auch noch zum Mischen von Firniß oder Lack mit Farben benutzt werden.

Die genannte Actiengesellschaft baut die Kataractmaschinen von 20 bis 400 Liter Inhalt, und kostet eine solche von 100 bis 125 Liter Inhalt mit eisernem Faß und rotirendem Dedel sammt großem Schwungrade für Handbetrieb 250 Mark D. Kw. ab Varel. Größere Maschinen werden nur für Kraftbetrieb mit Riemenscheiben geliefert.

Ein großer Theil des im Handel vorkommenden Leinöles wird mit Schwefelsäure gereinigt und kennt man verschiedene Verfahrungsweisen.

Defendant's Exhibit No. 51.

*Depts as 5-1
adm*

(Title Page, "AGRICOLA DE RE METALLICA" (Hoover Translation)
is as follows:)

GEORGIUS AGRICOLA

DE RE METALLICA

Translated from the First Latin Edition of 1556,
with

Biographical Introduction, Annotations and Appendices upon
the Development of Mining Methods, Metallurgical
Processes, Geology, Mineralogy & Mining Law
from the earliest times to the 16th Century,

by

HERBERT CLARK HOOVER

A.B. Stanford University, Member American Institute of Mining
Engineers, Mining and Metallurgical Society of America,
Societe des Ingenieurs Civils de France, American
Institute of Civil Engineers, Fellow Royal Geographical
Society, etc. etc.

and

LOU HENRY HOOVER

A.B. Stanford University, Member American Association for the
Advancement of Science, The National Geographical Society,
Royal Scottish Geographical Society, etc. etc.

Published for the Translators by

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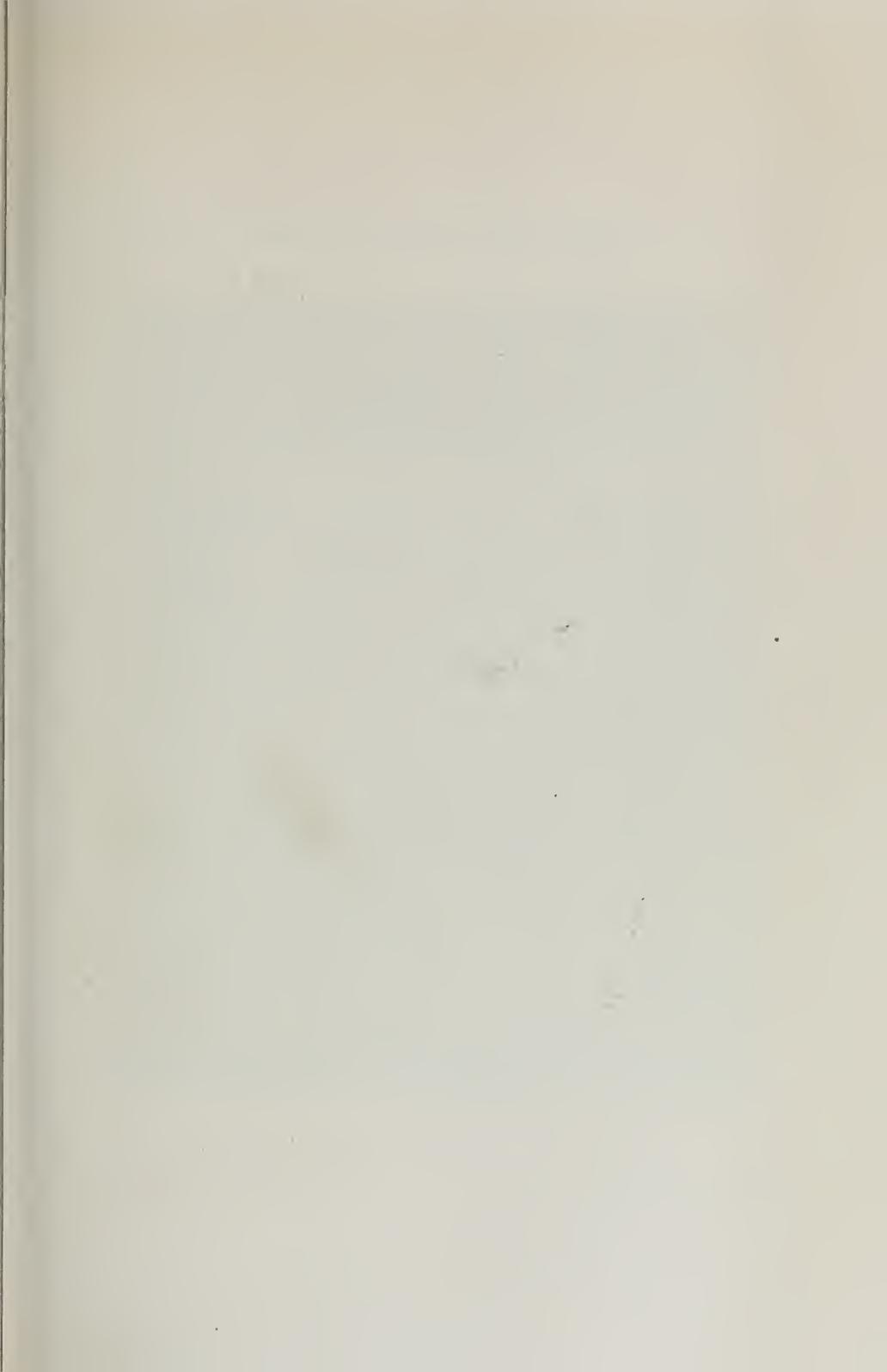
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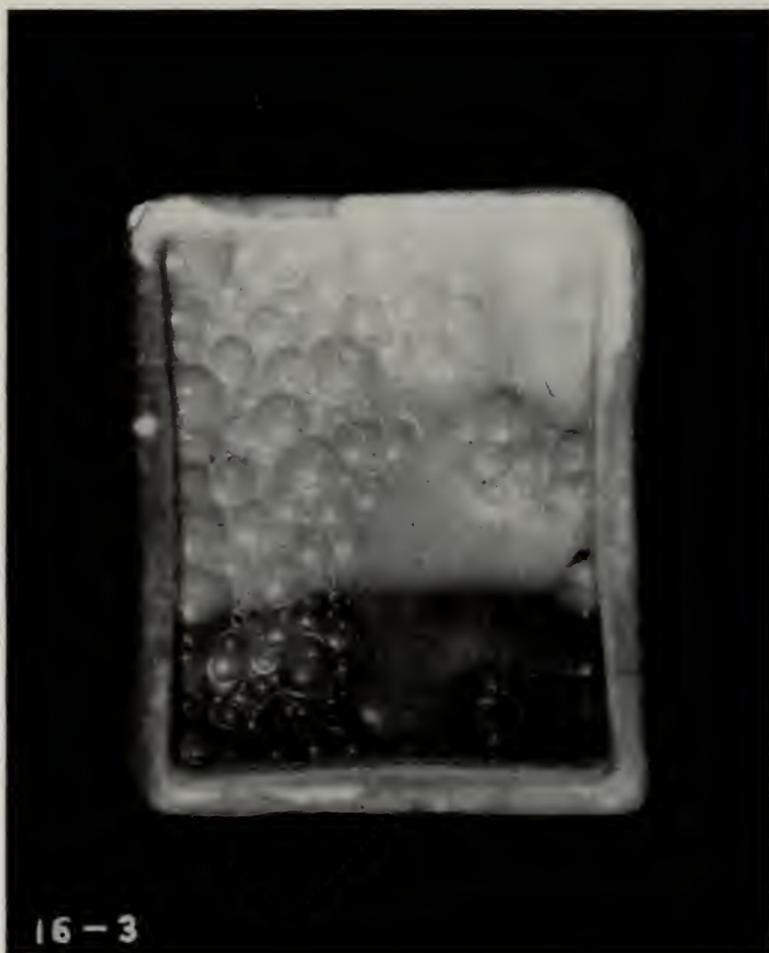
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BOOK VIII



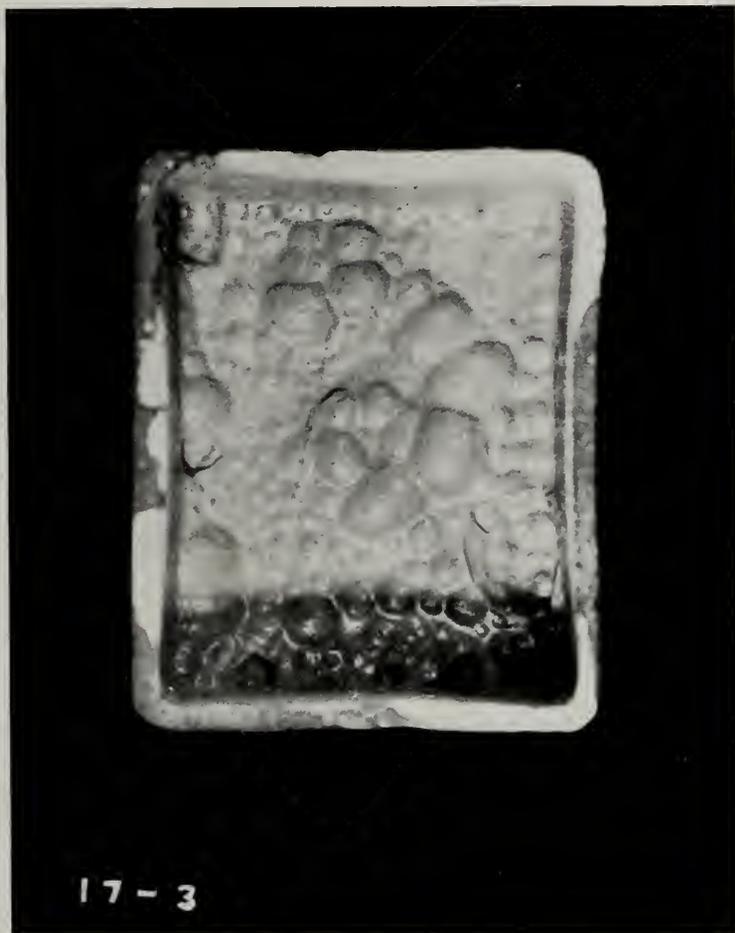
A—WATER-WHEEL. B—AXLE. C—STAMP. D—HOPPER IN THE UPPER MILLSTONE. E—OPENING PASSING THROUGH THE CENTRE. F—LOWER MILLSTONE. G—ITS ROUND DEPRESSION. H—ITS OUTLET. I—IRON AXLE. K—ITS CROSSPIECE. L—BEAM. M—DRUM OF RUNDLES ON THE IRON AXLE. N—TOOTHED DRUM OF MAIN AXLE. O—TUBS. P—THE SMALL PLANKS. Q—SMALL UPRIGHT AXLES. R—ENLARGED PART OF ONE. S—THEIR PADDLES. T—THEIR DRUMS WHICH ARE MADE OF RUNDLES. V—SMALL HORIZONTAL AXLES SET INTO THE END OF THE MAIN AXLE. X—ITS TOOTHED DRUMS. Y—THREE SLUICES. Z—THEIR SMALL AXLES. AA—SPOKES. BB—PADDLES.



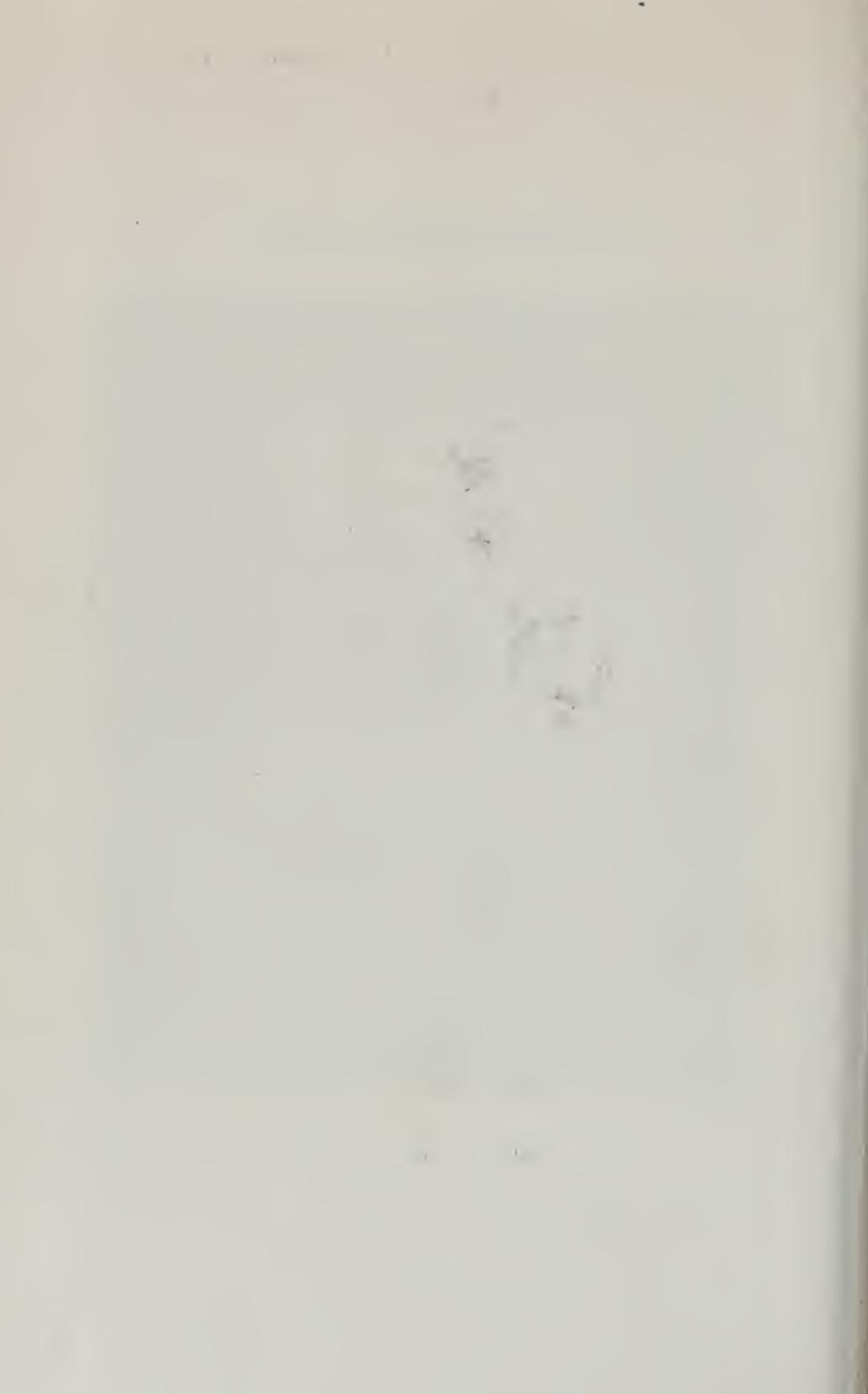
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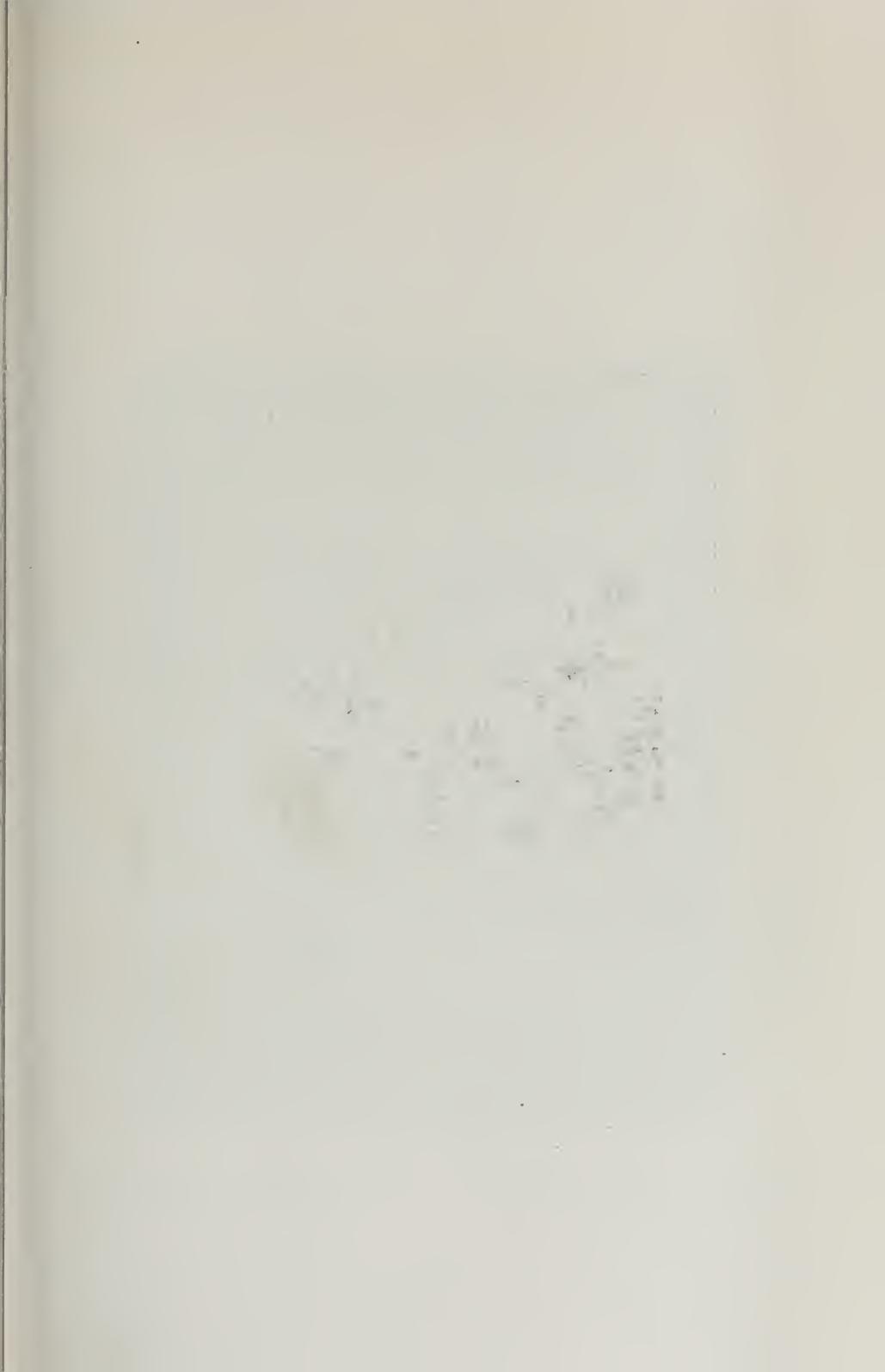
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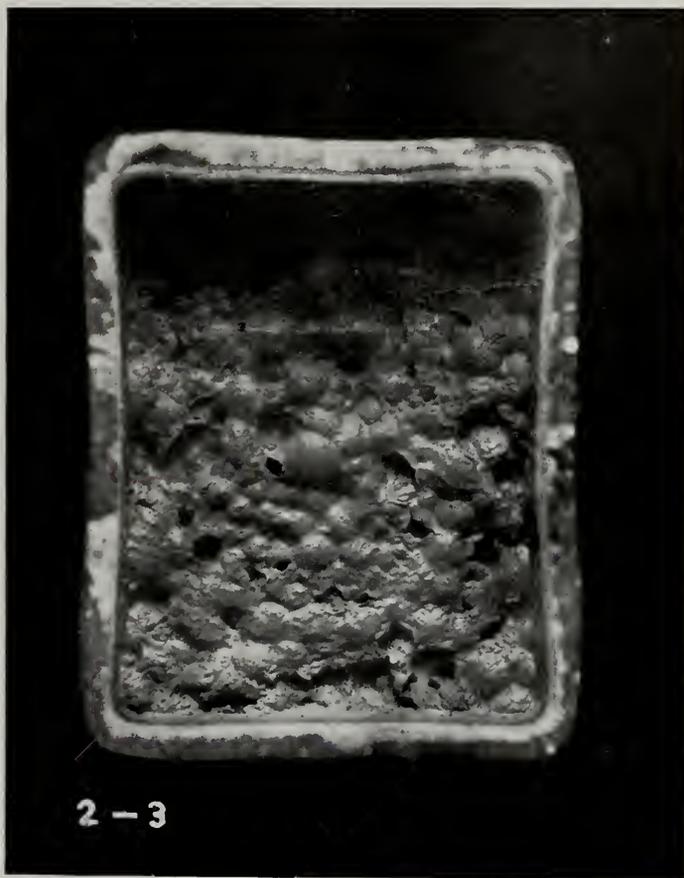




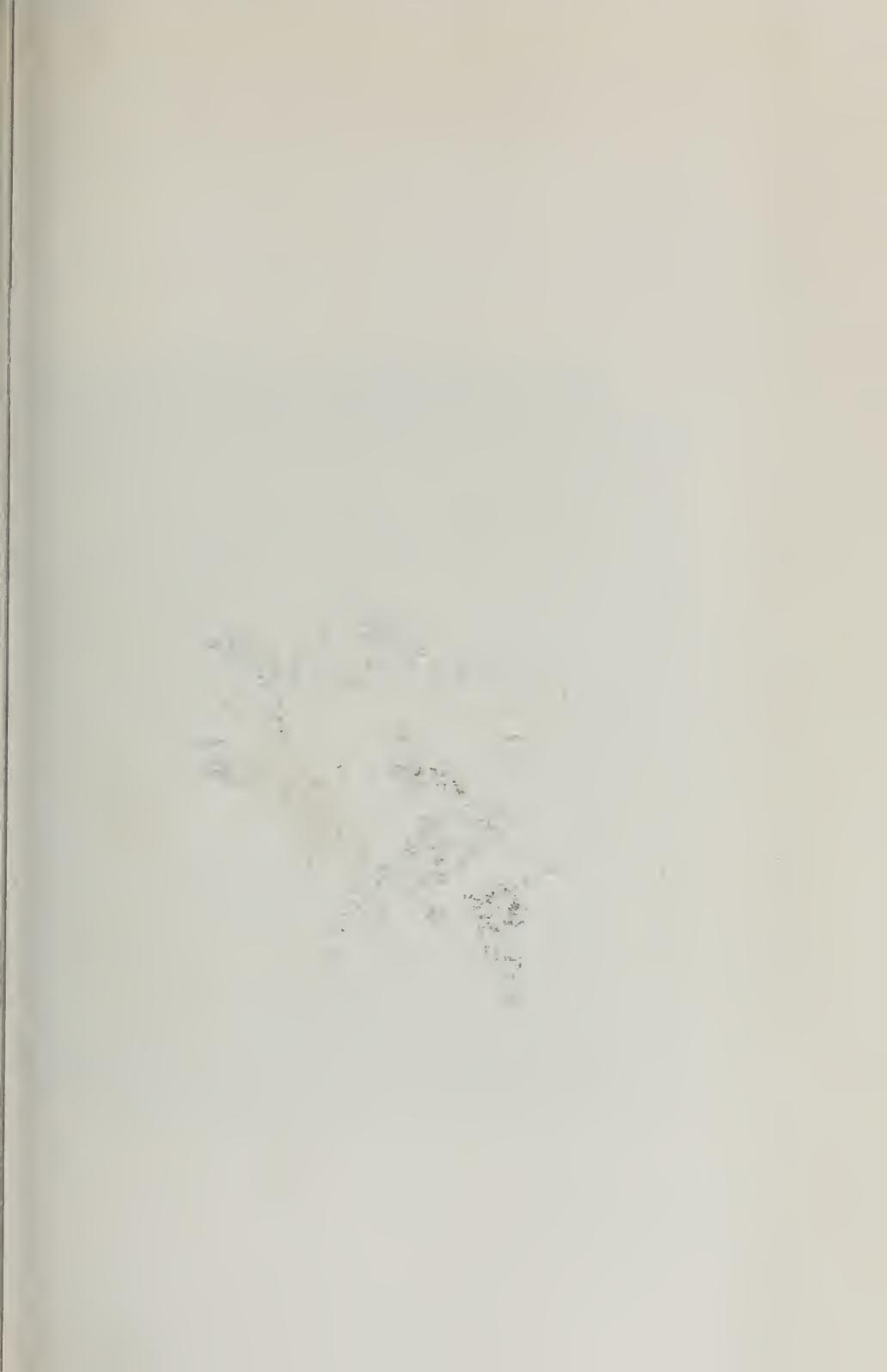
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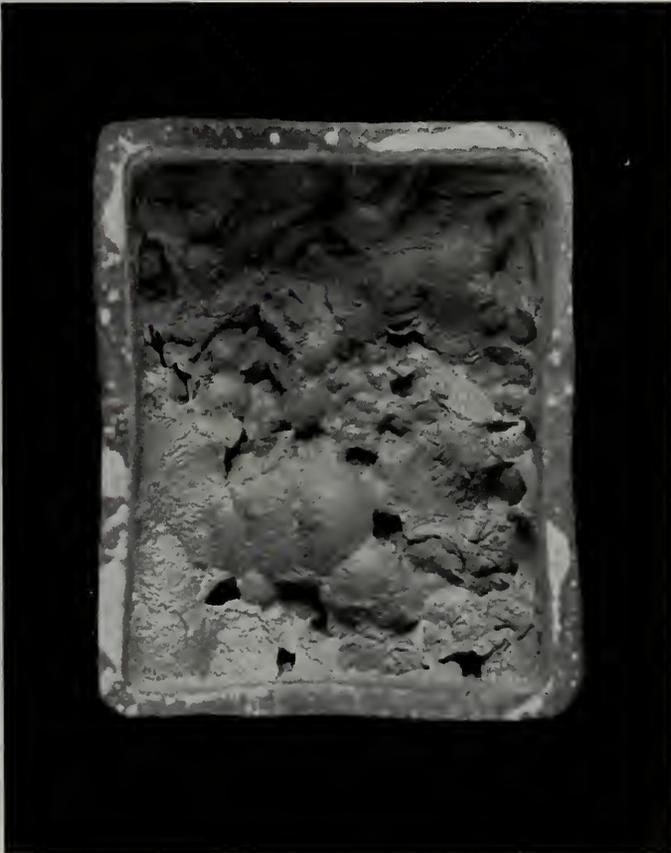
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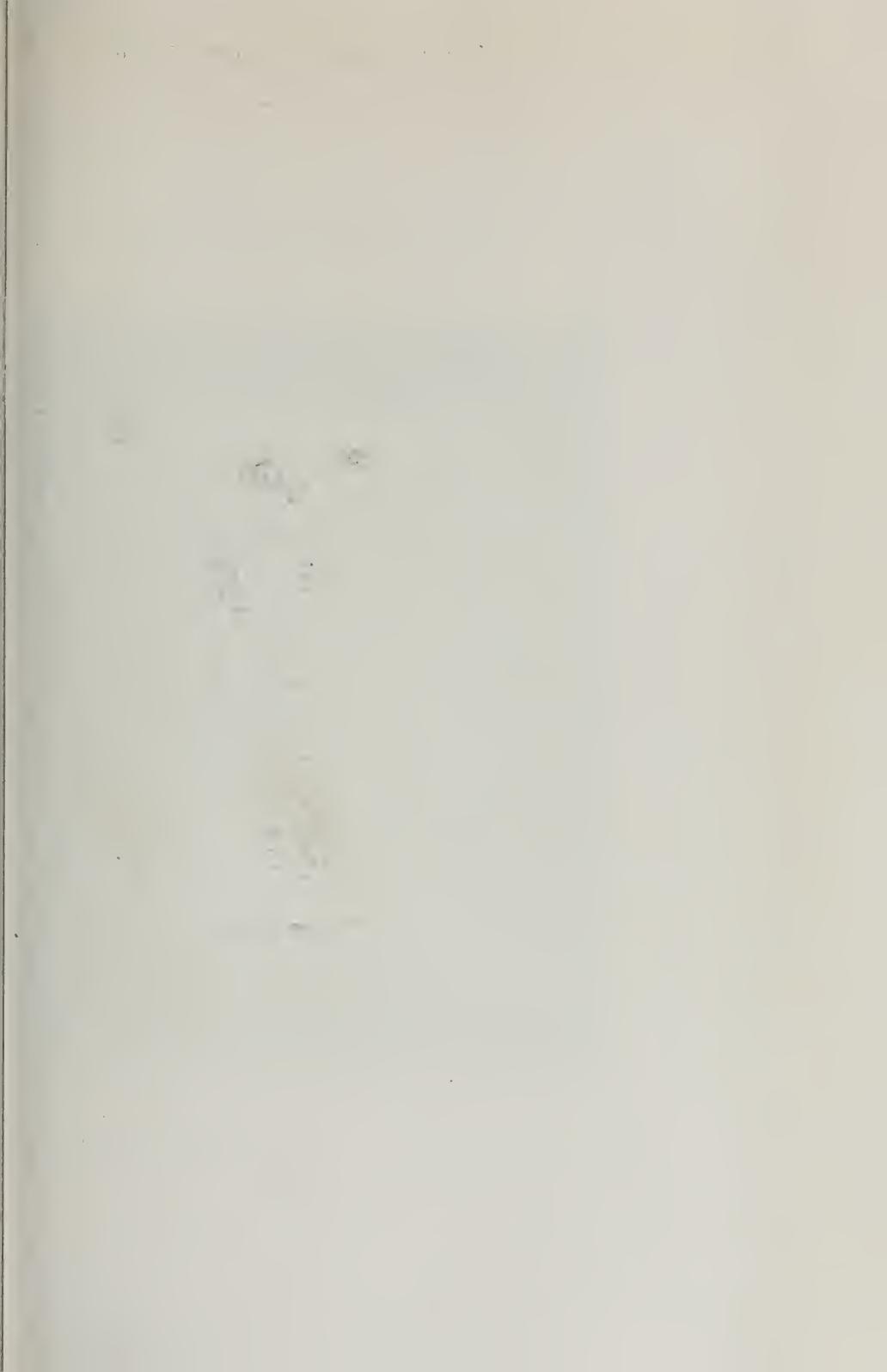
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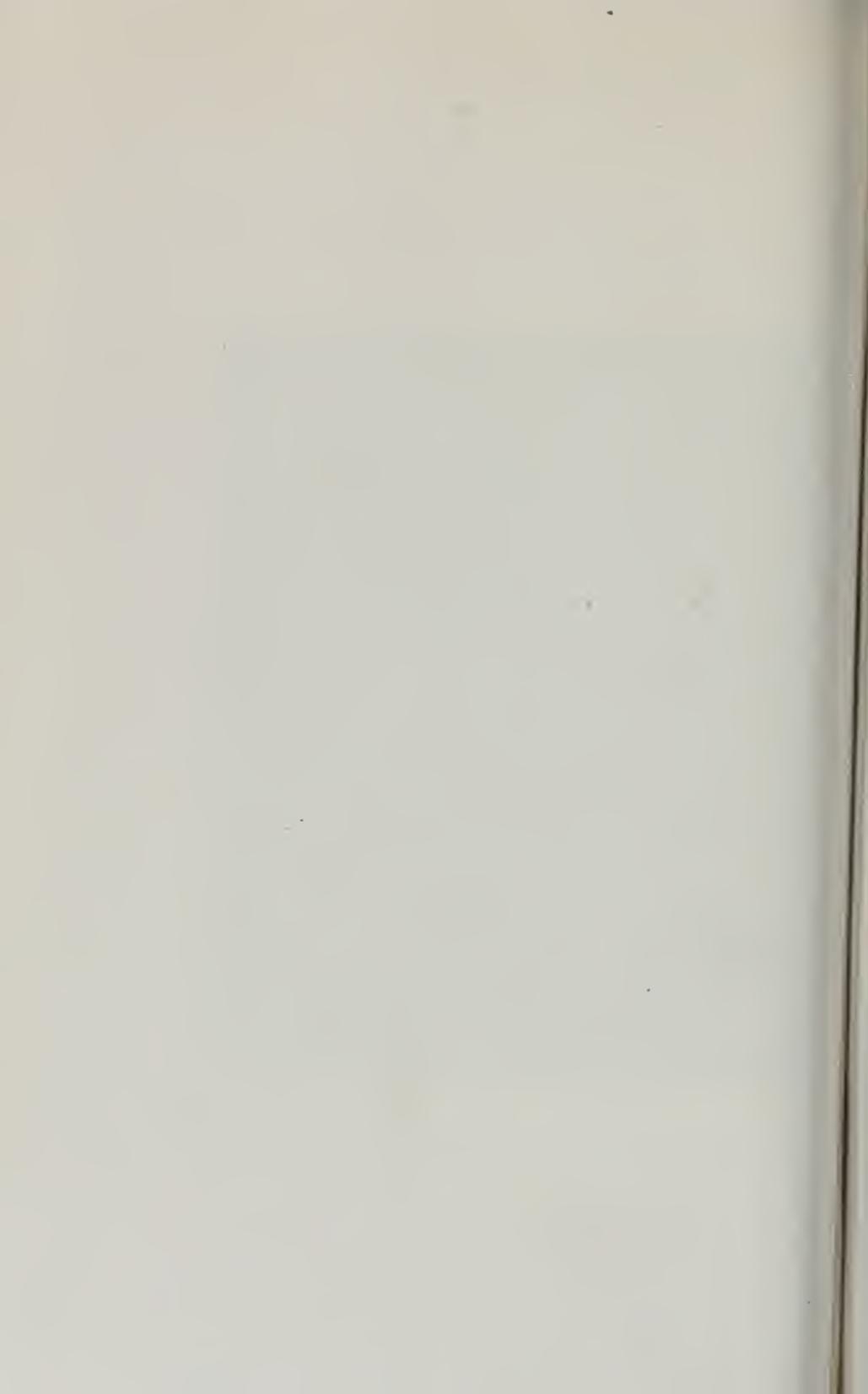
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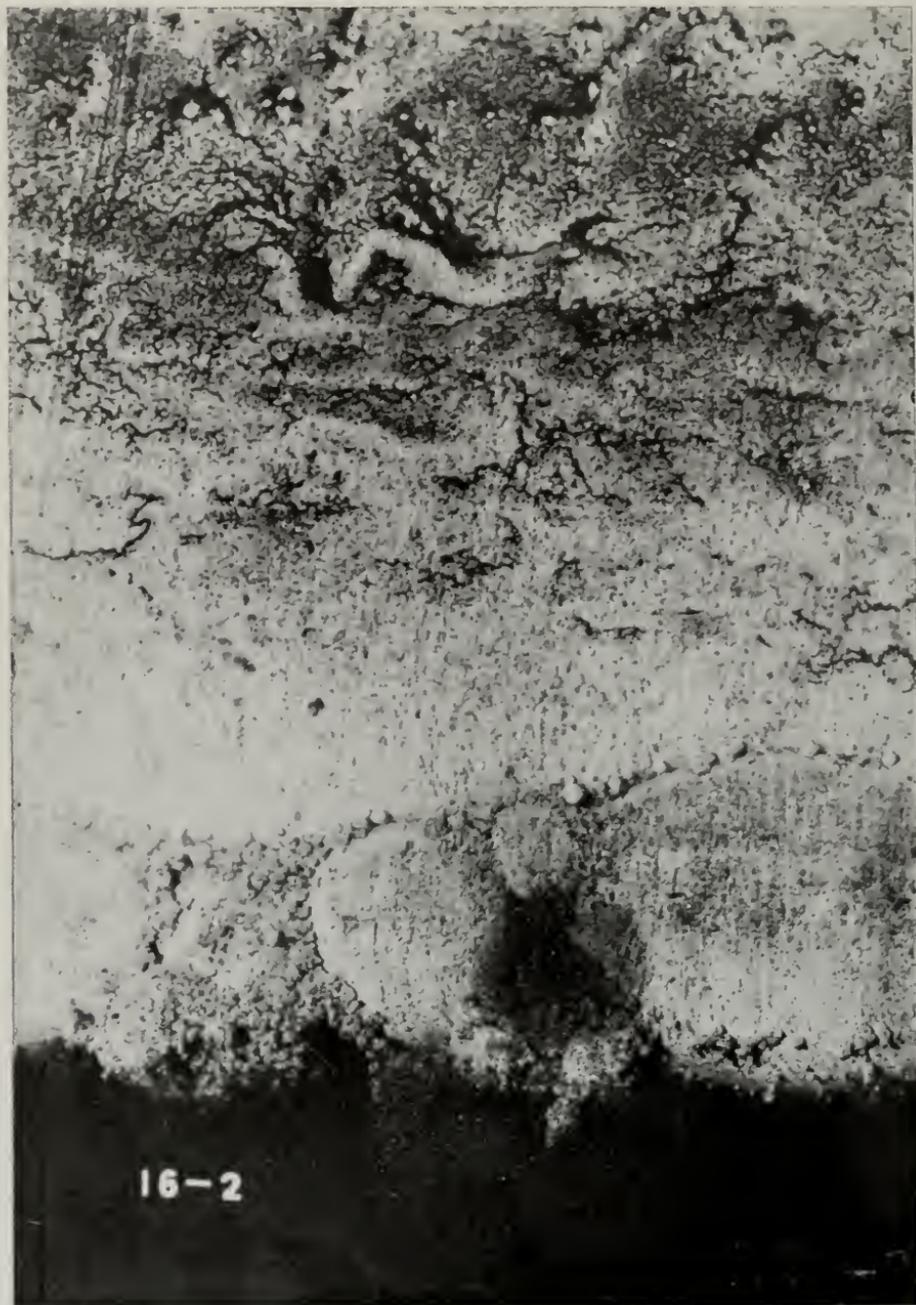
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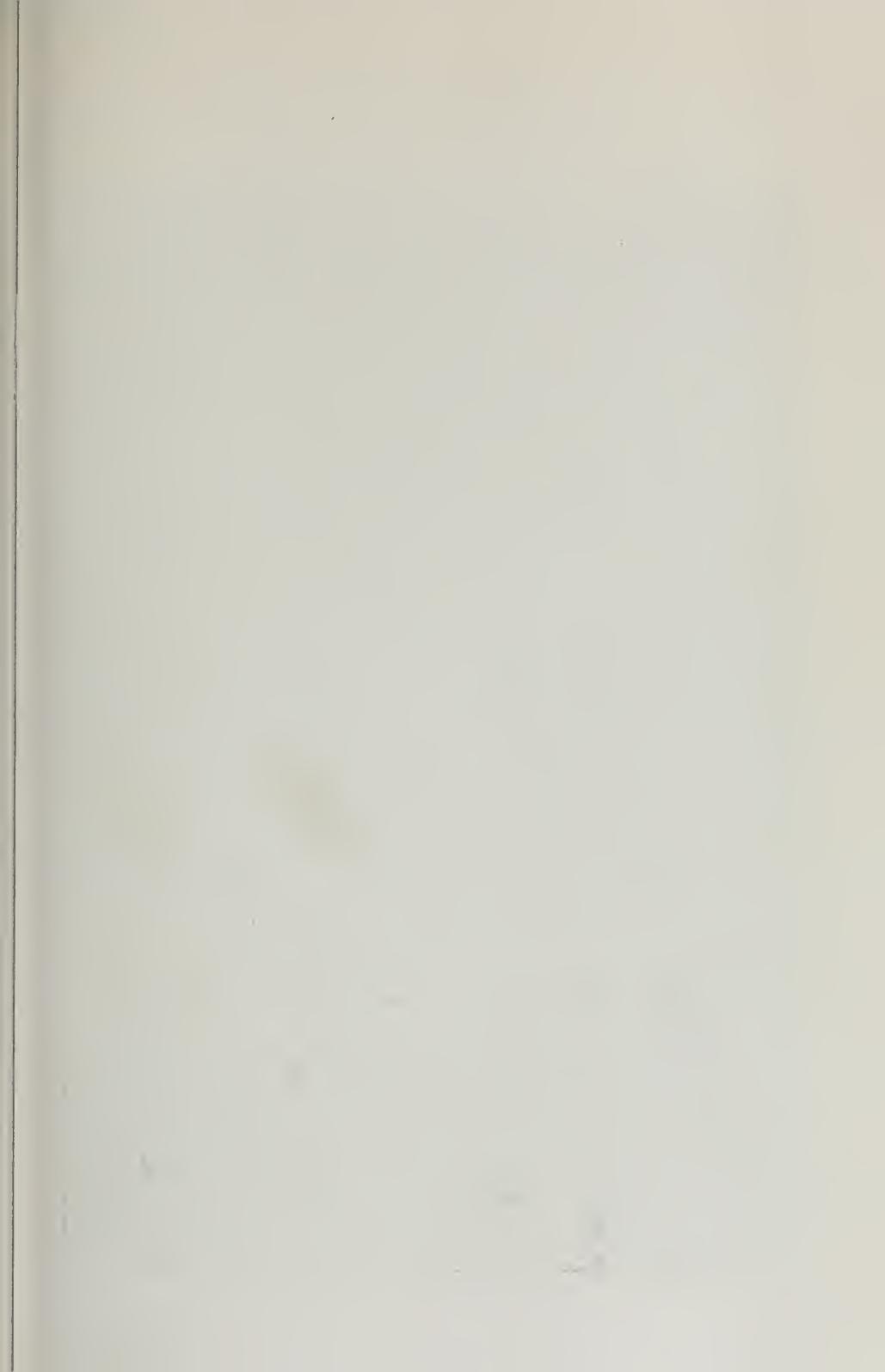
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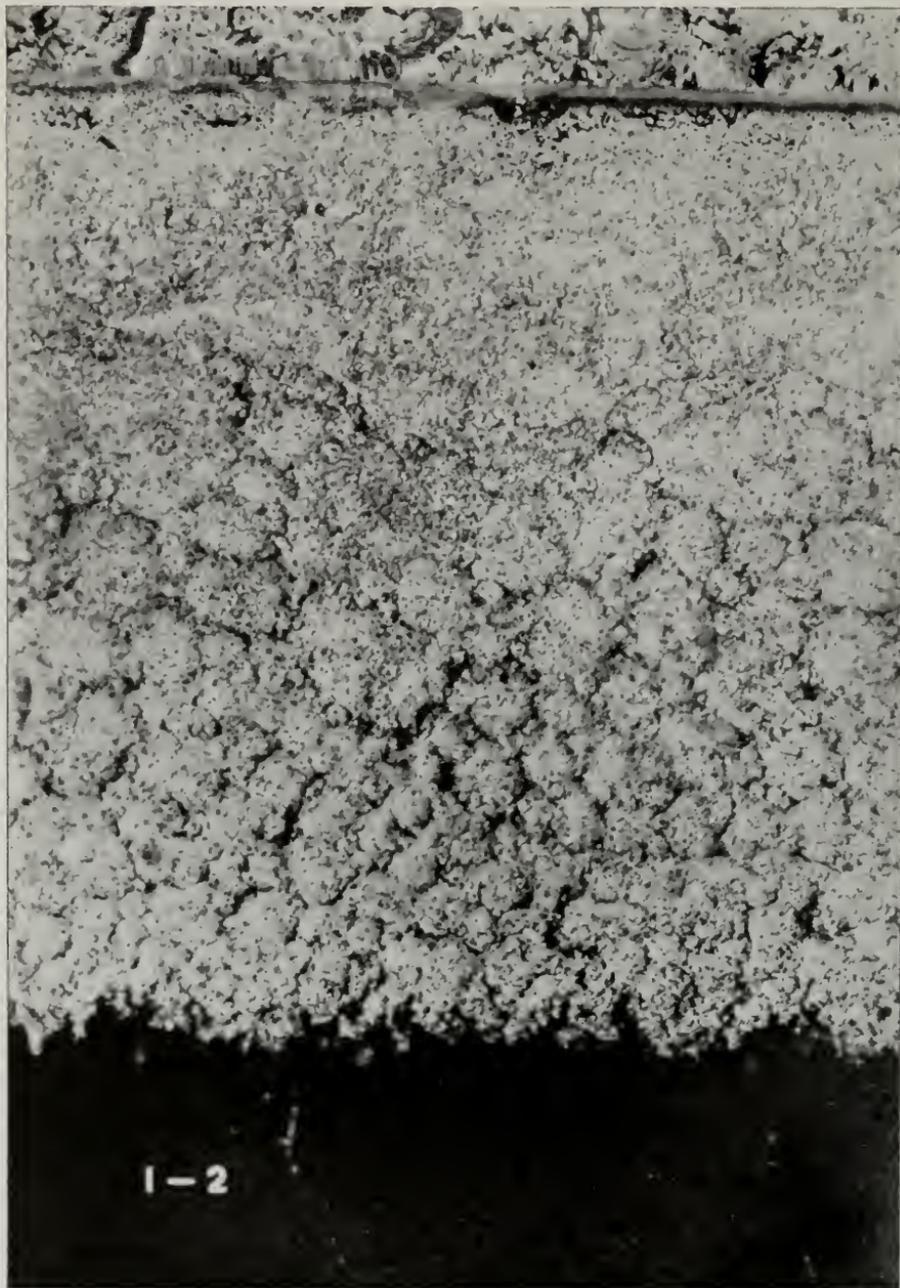


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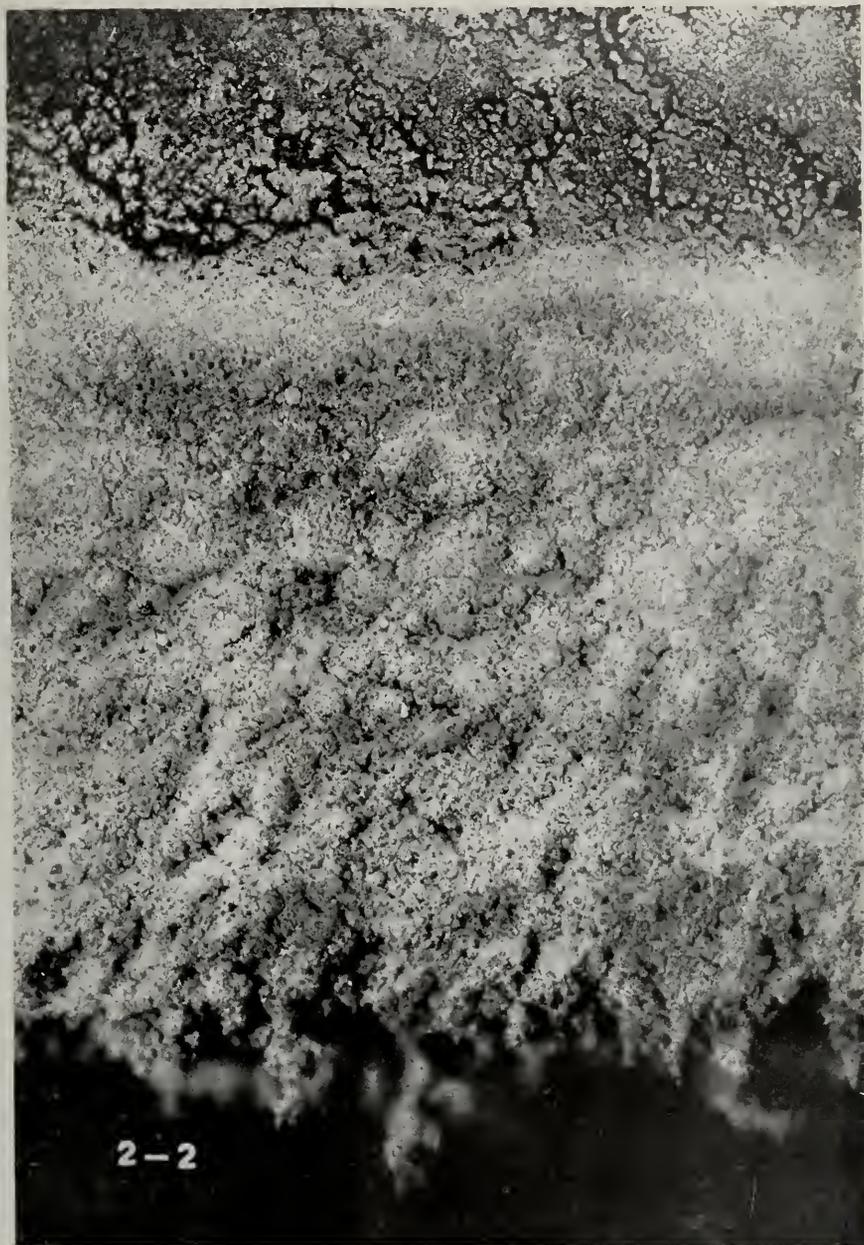




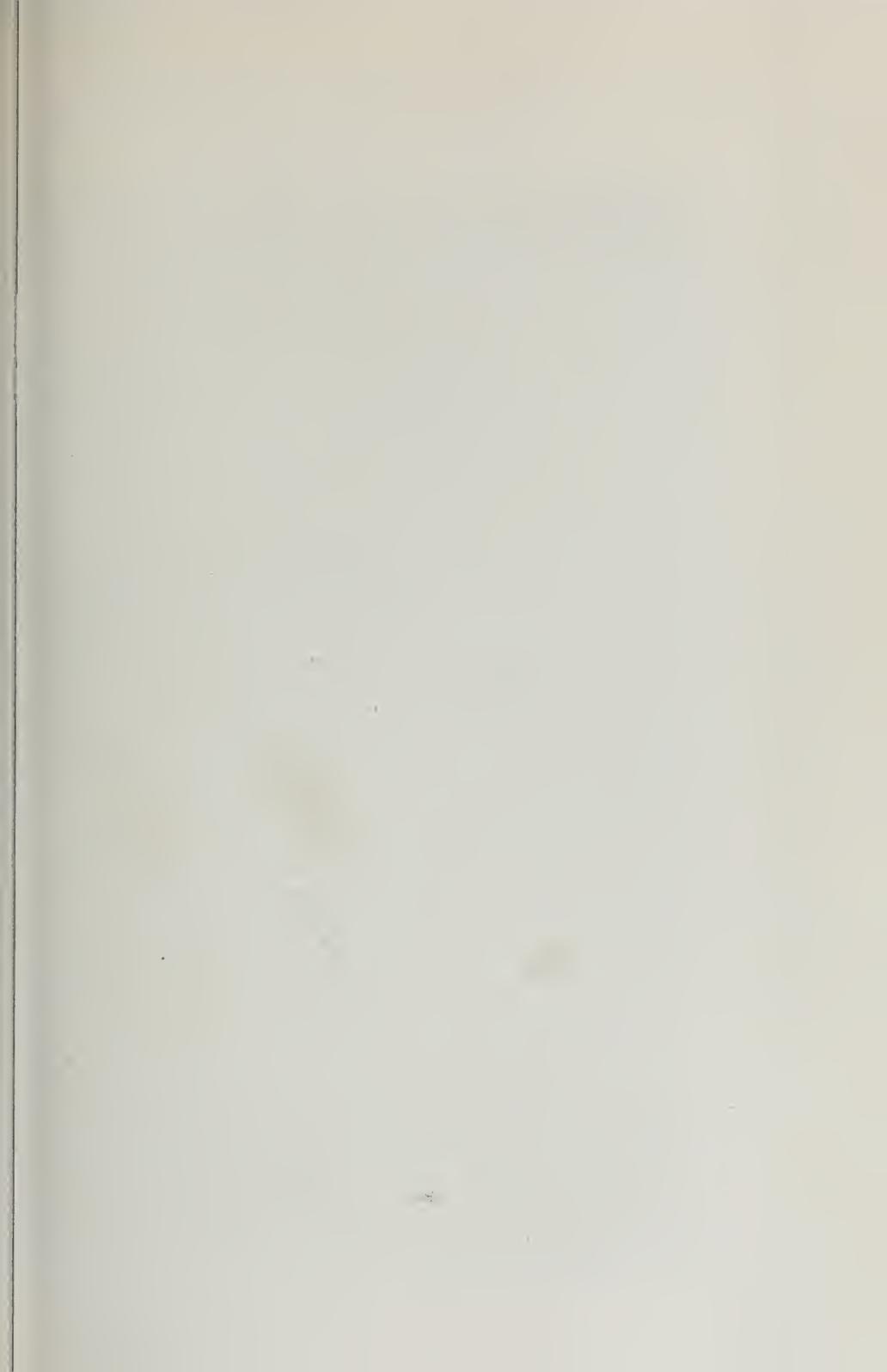
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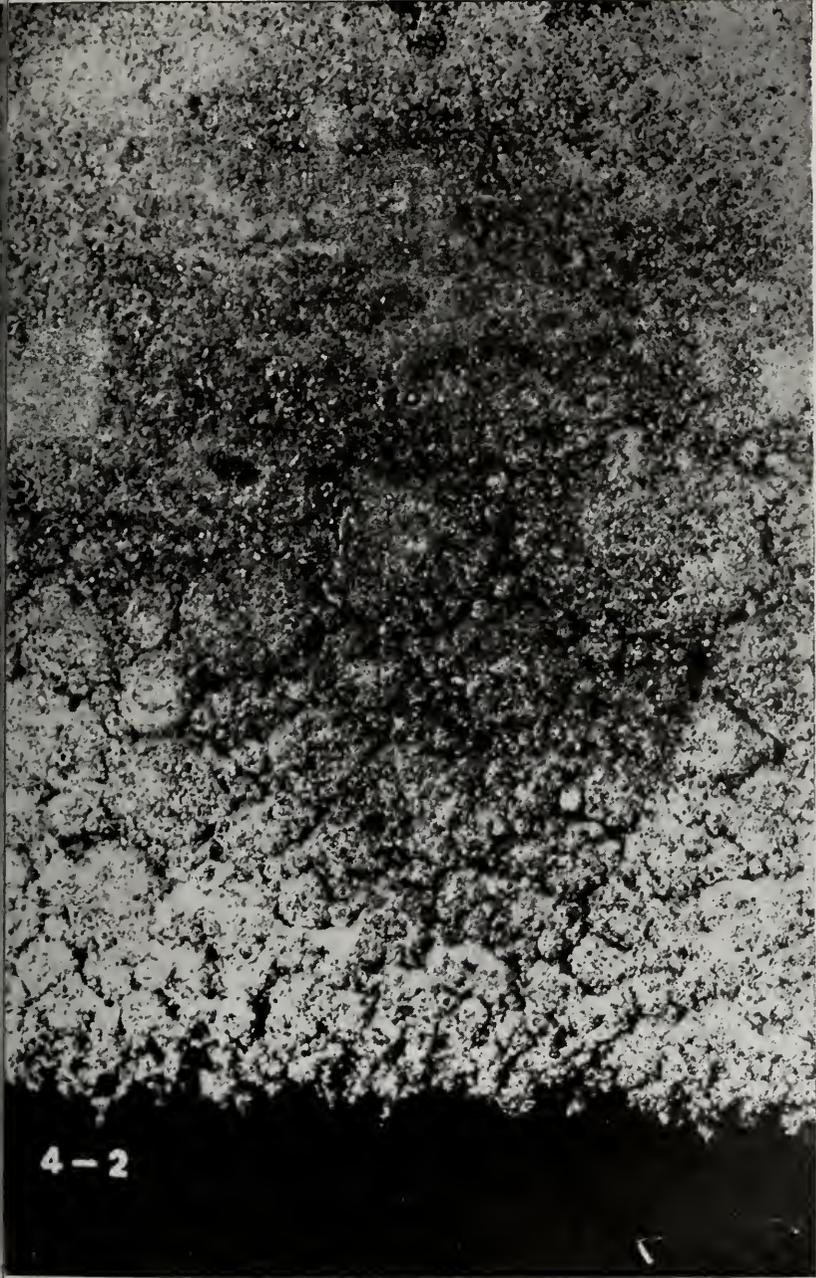


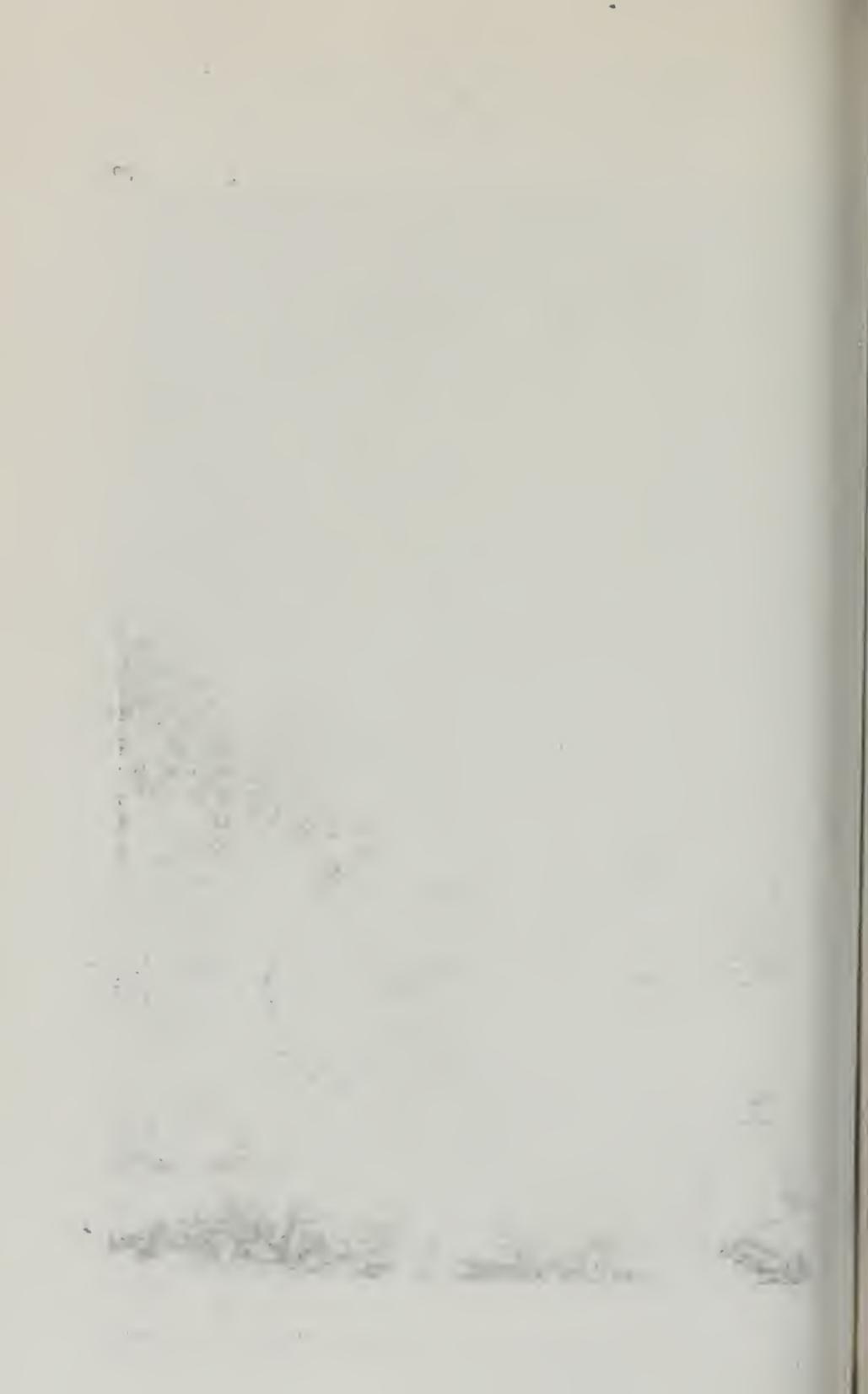


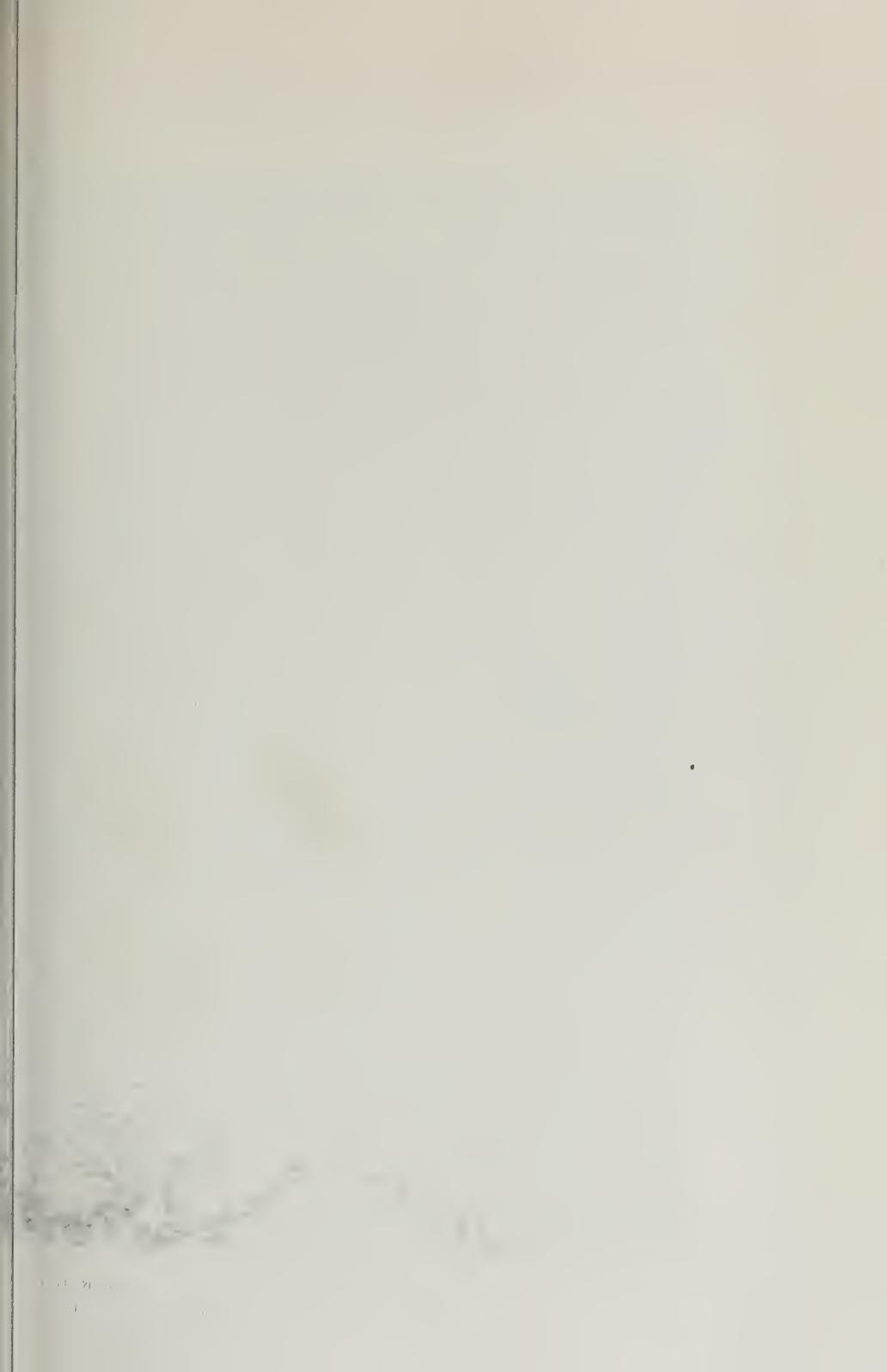
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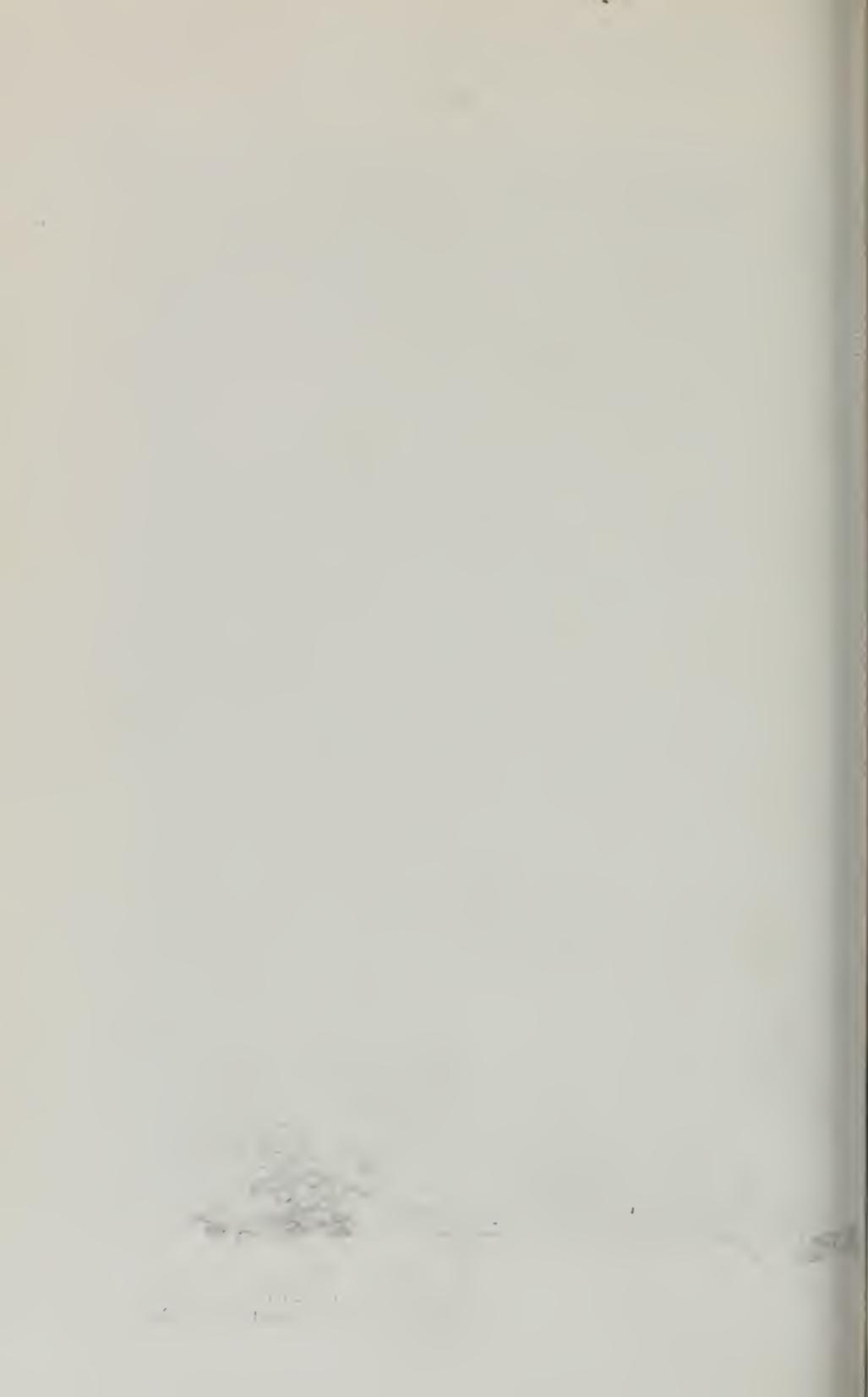


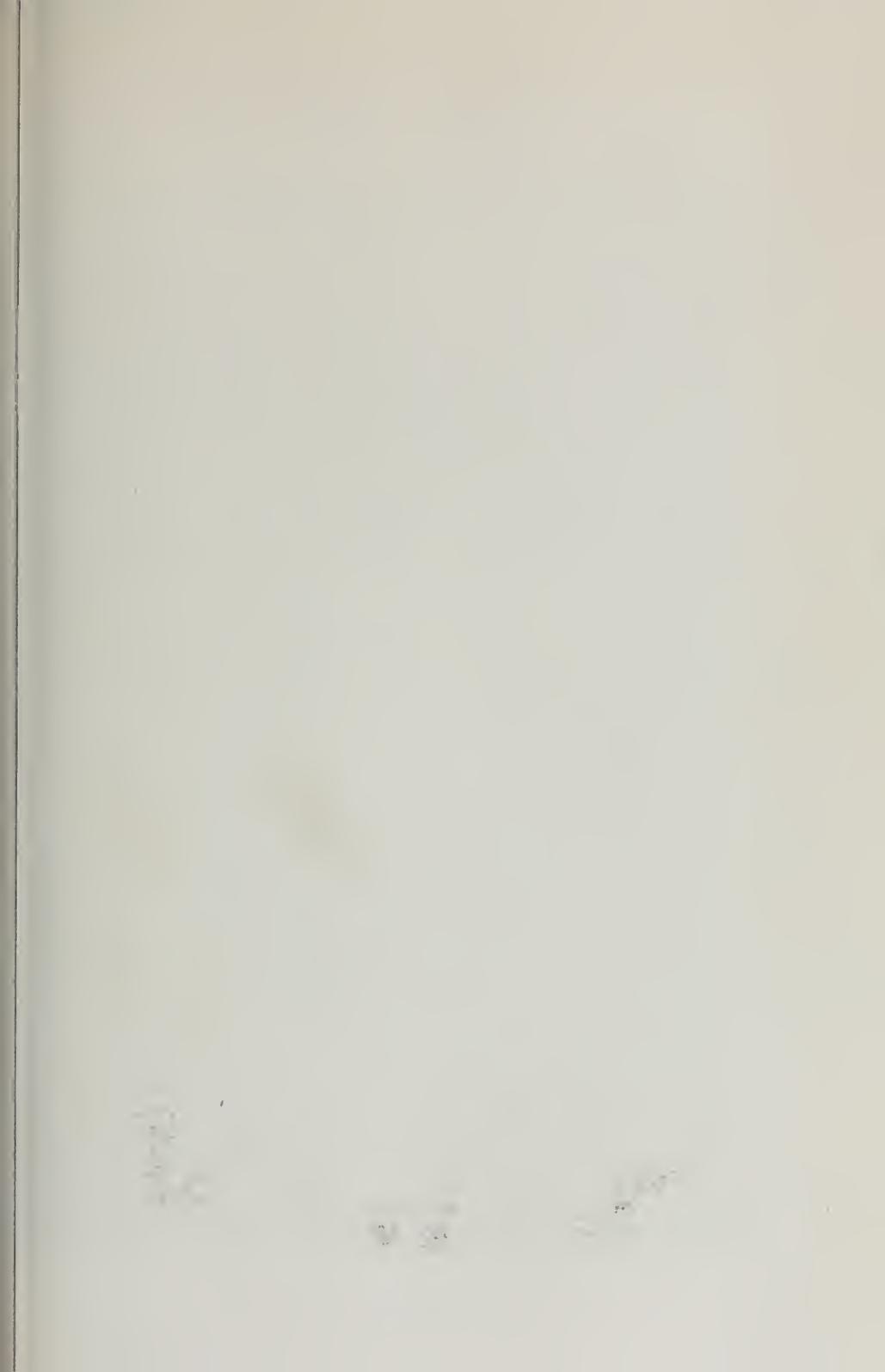
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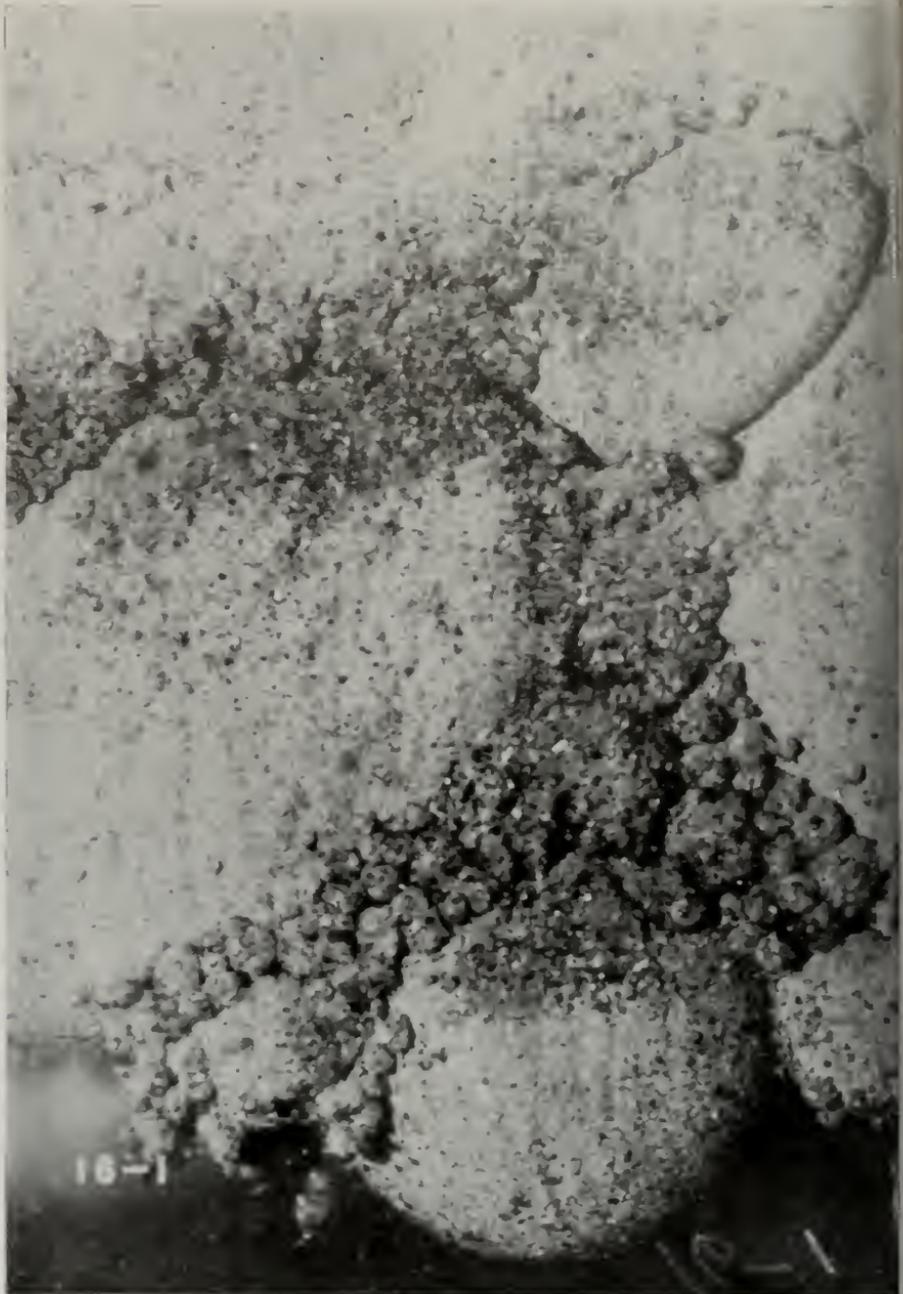
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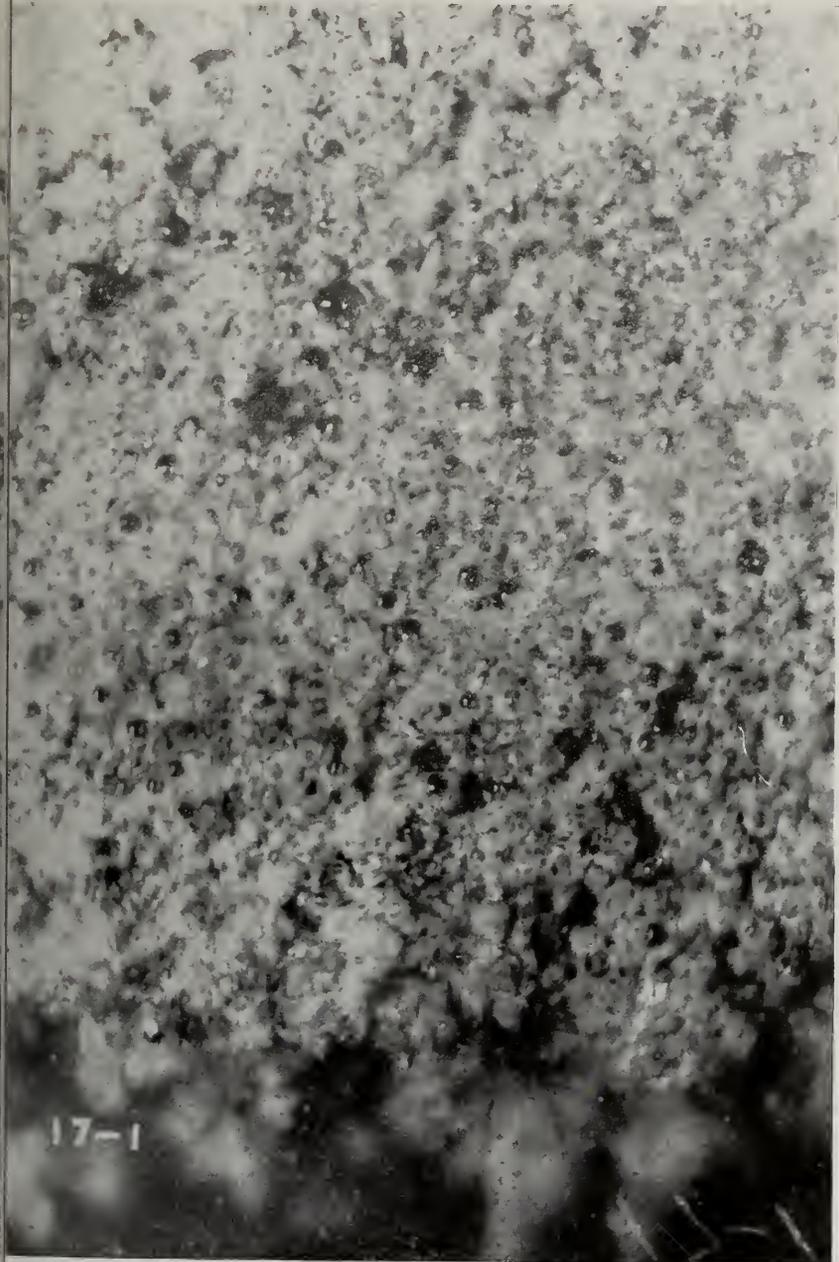


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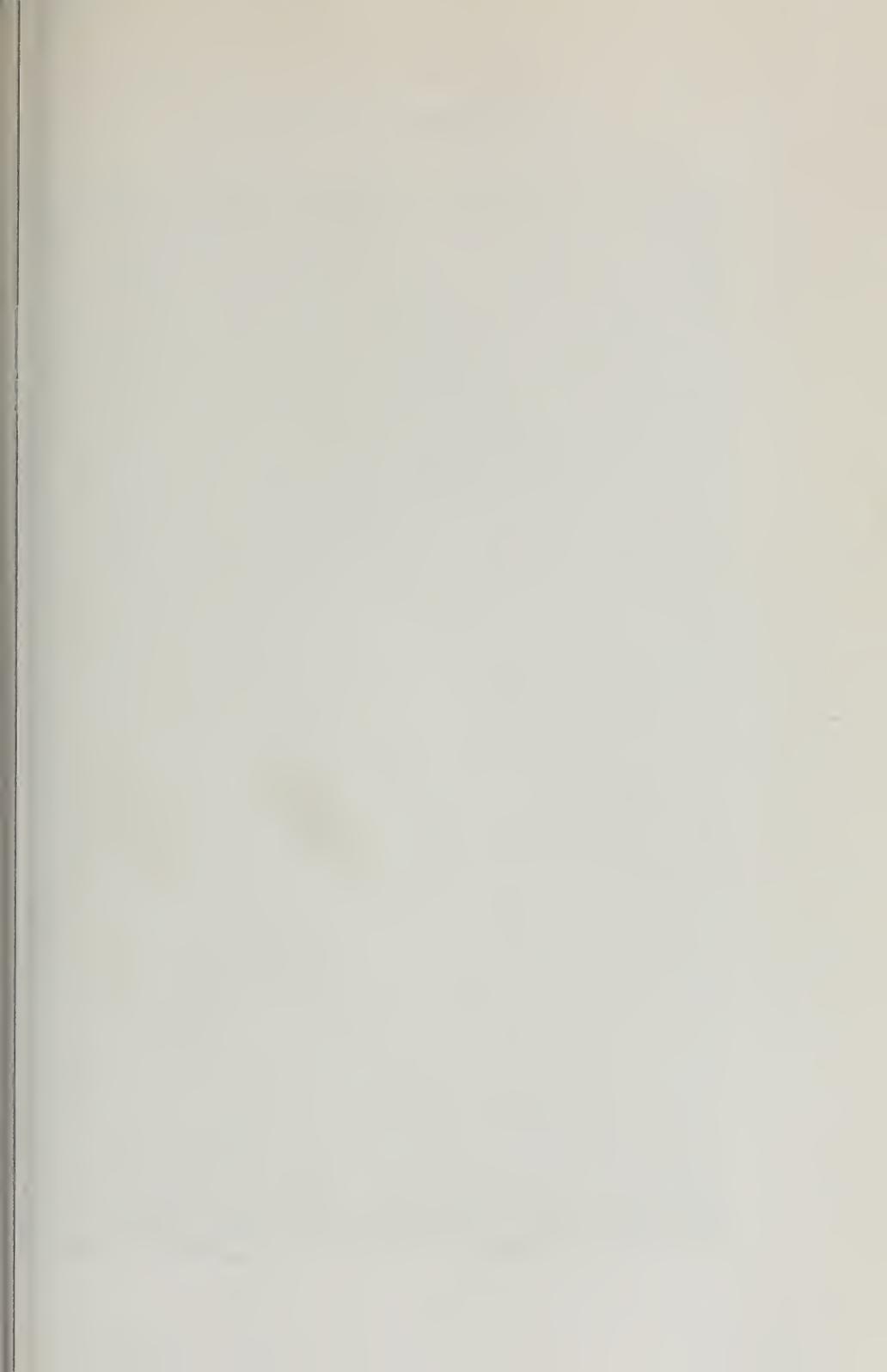
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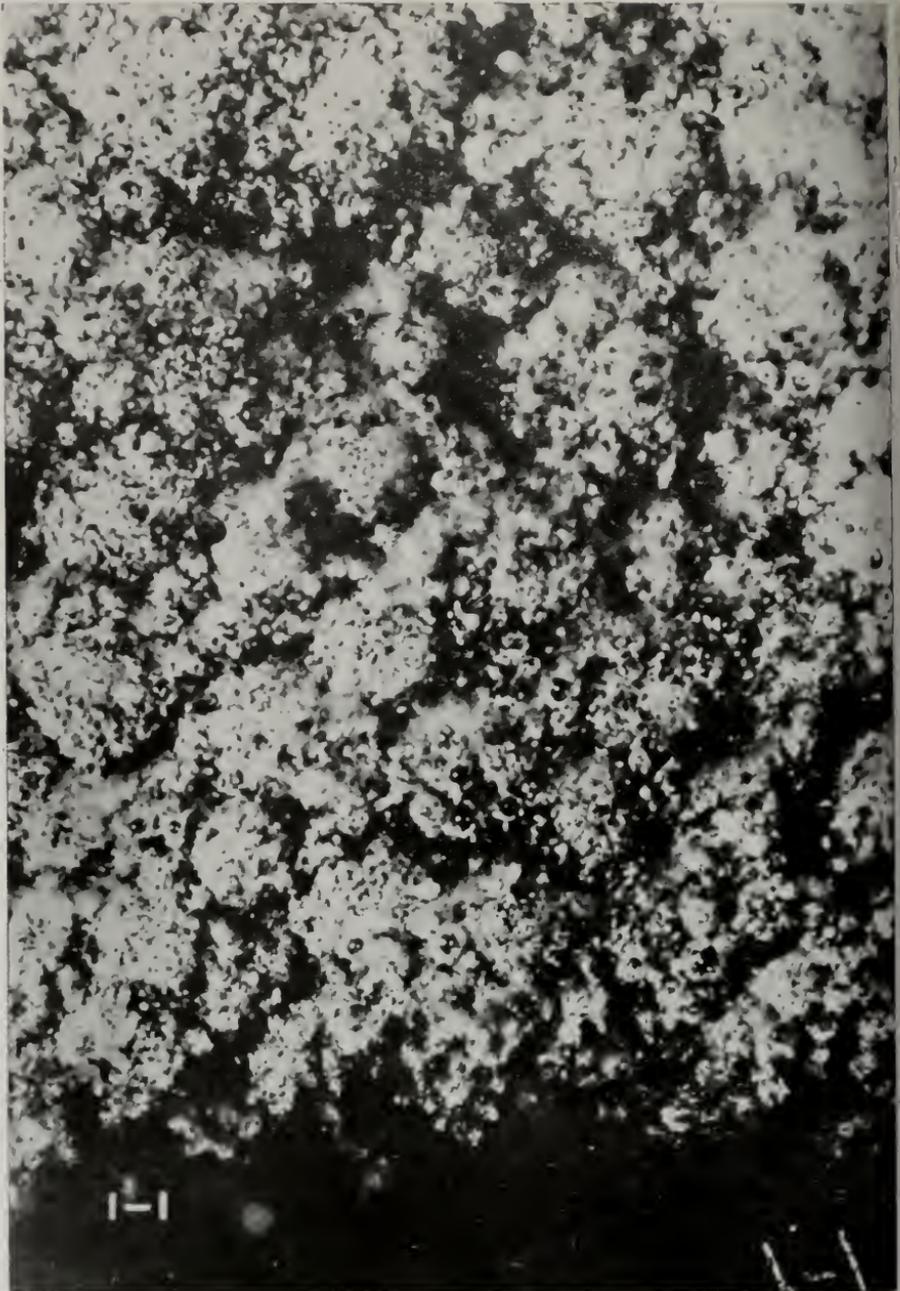


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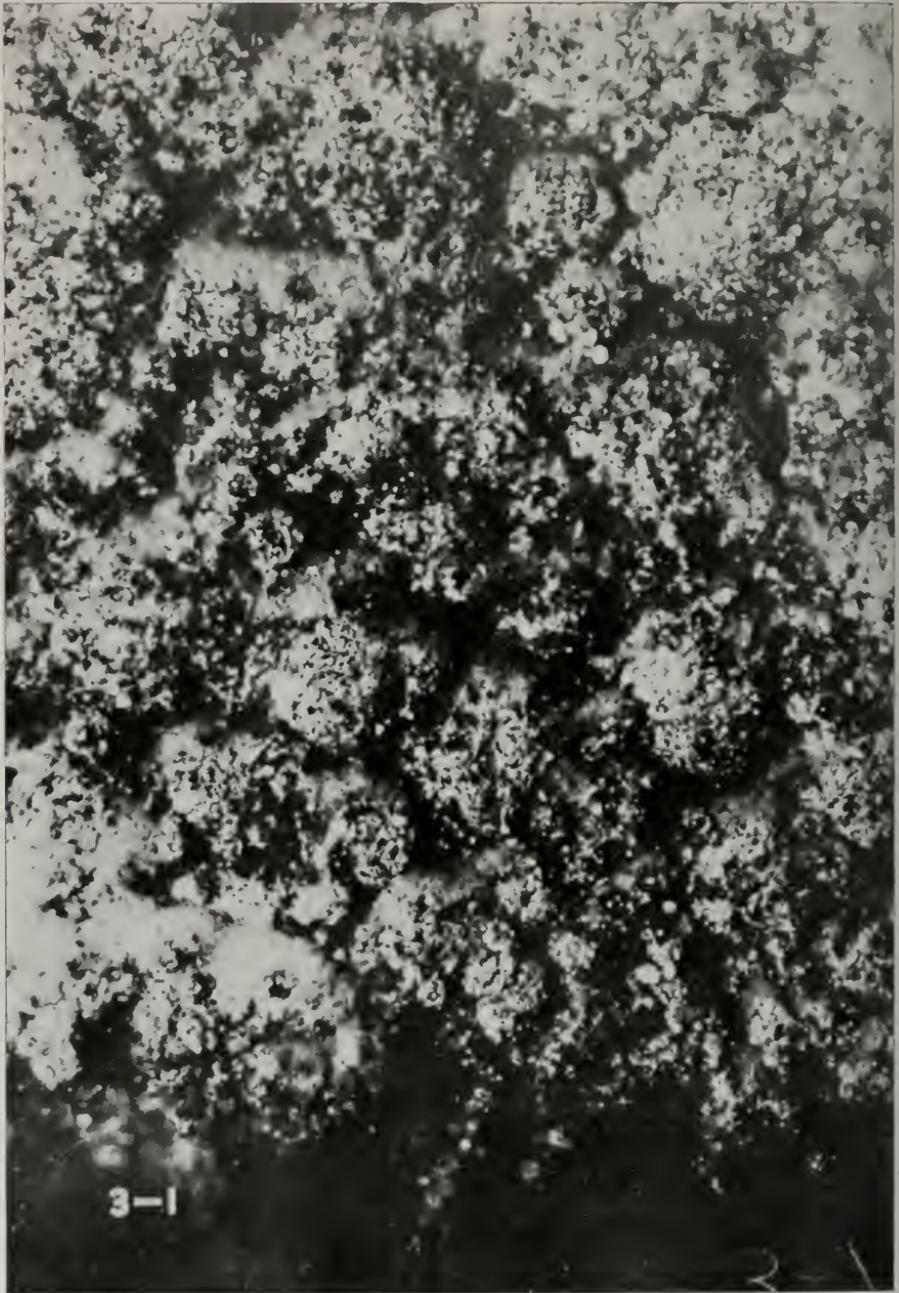
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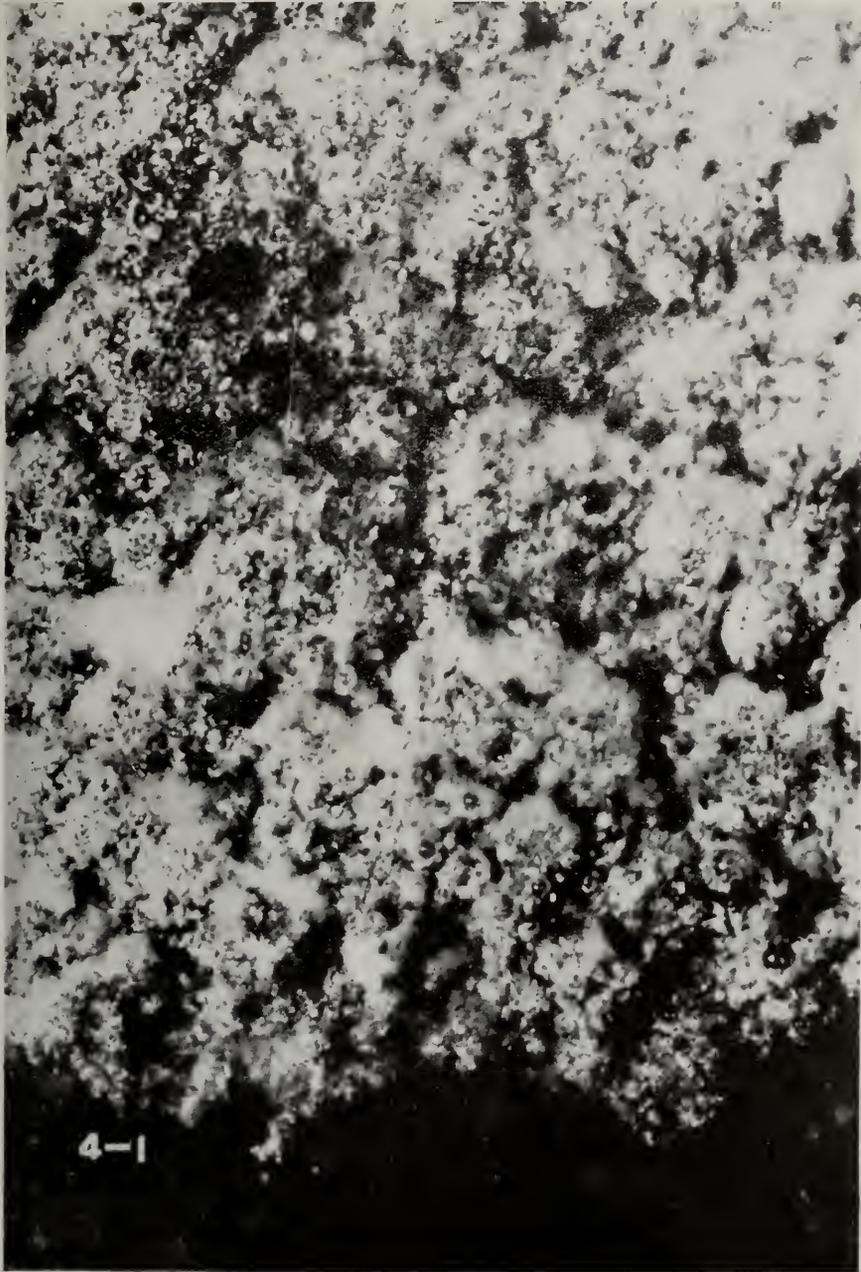


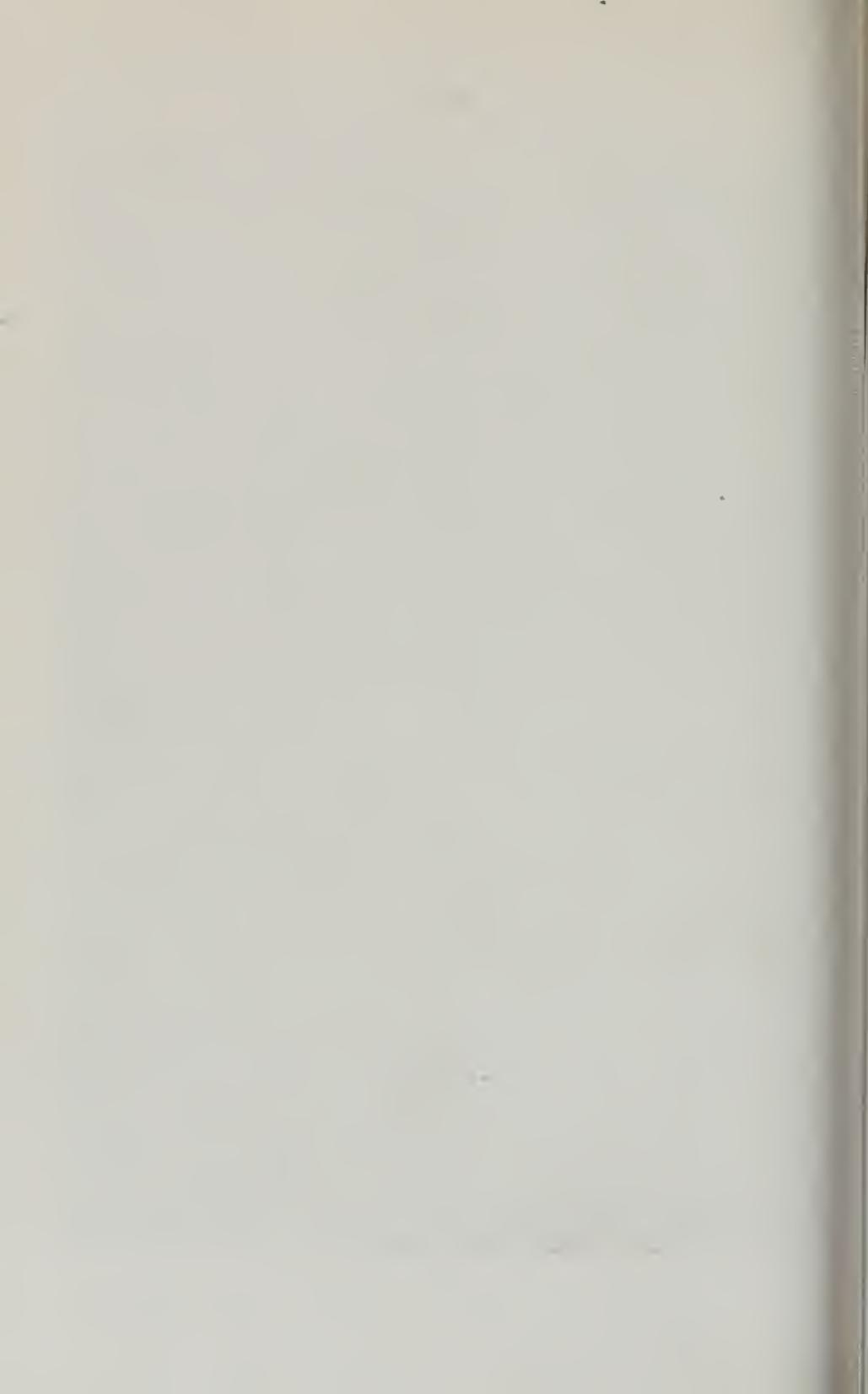
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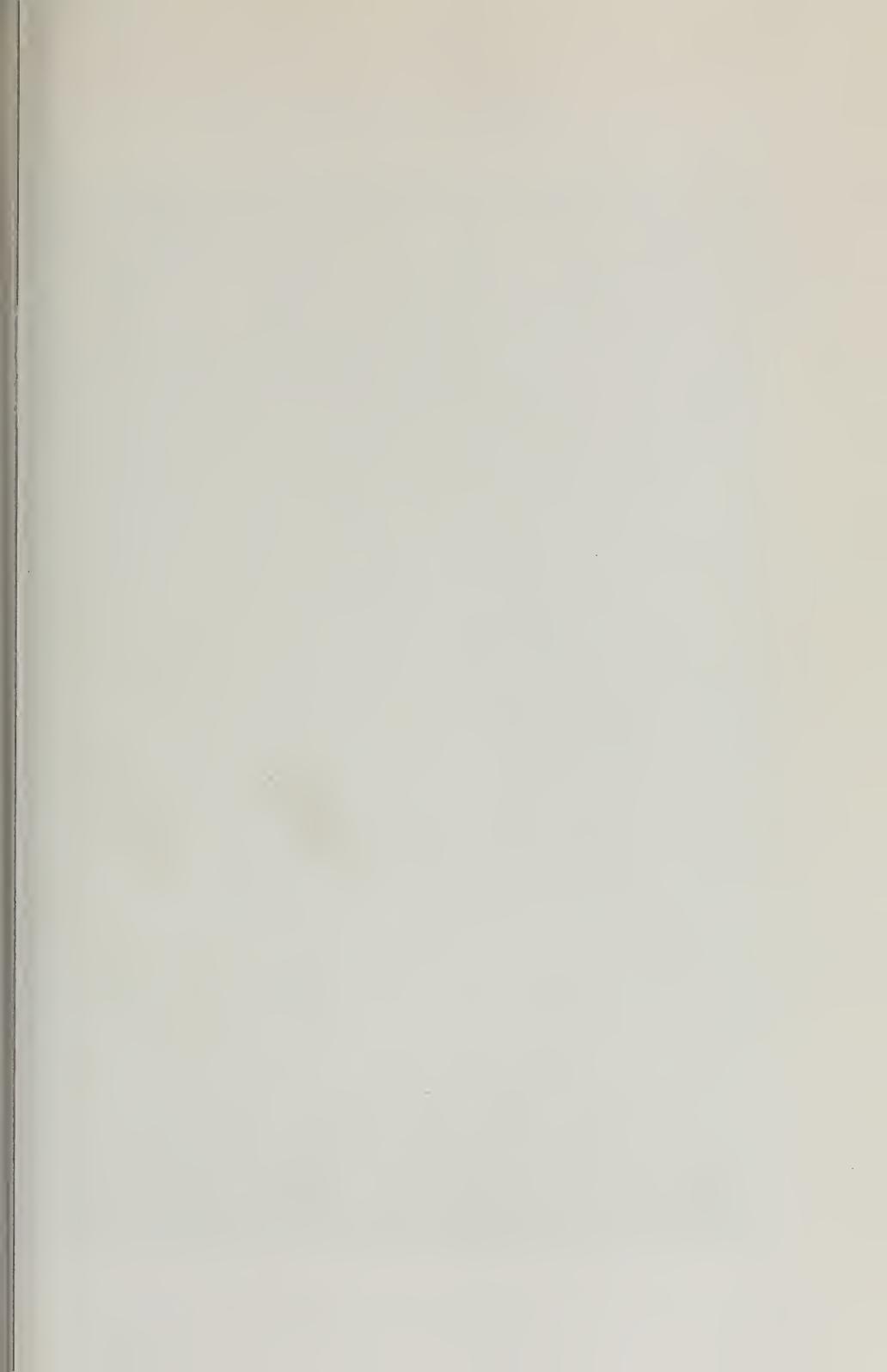


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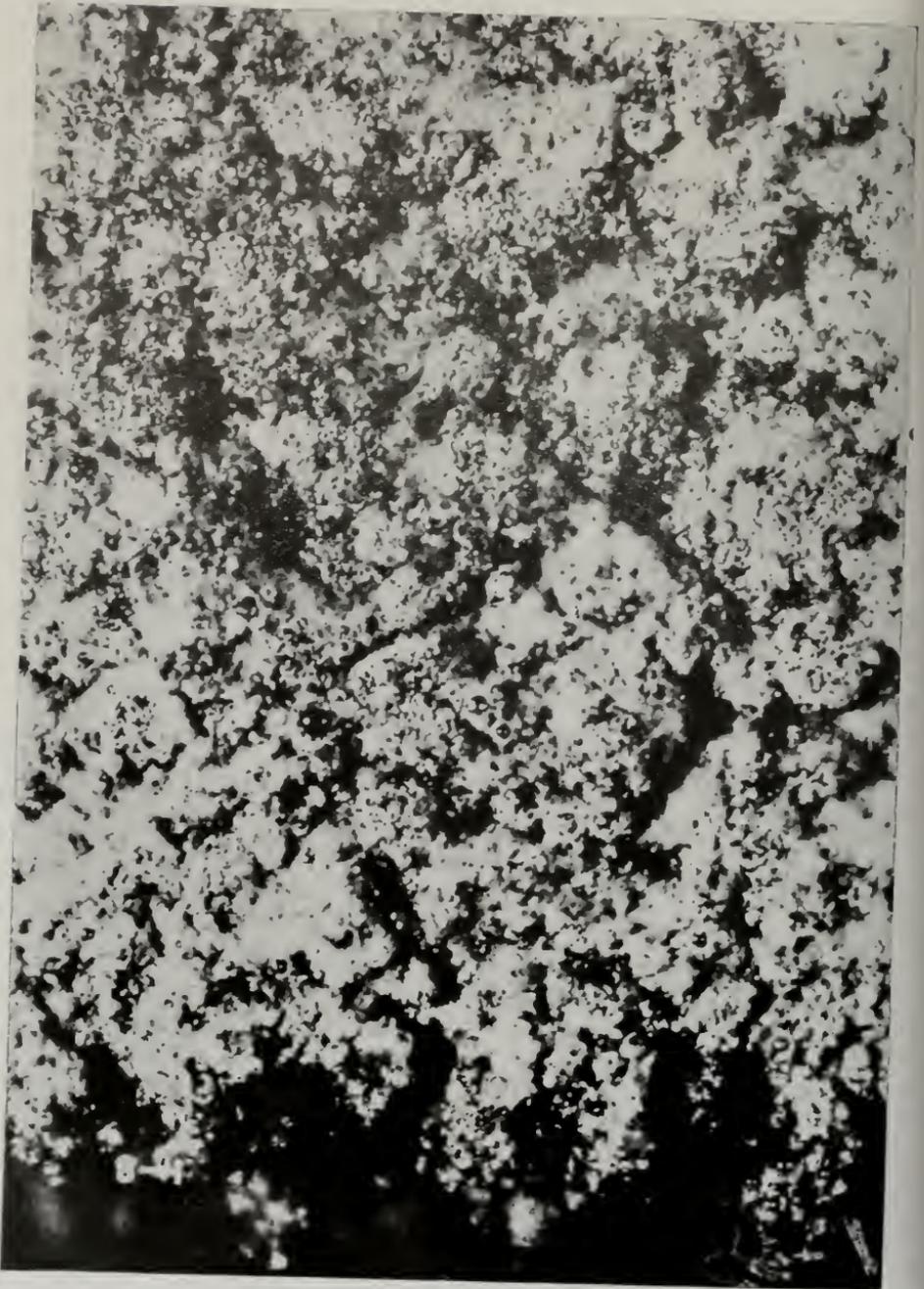
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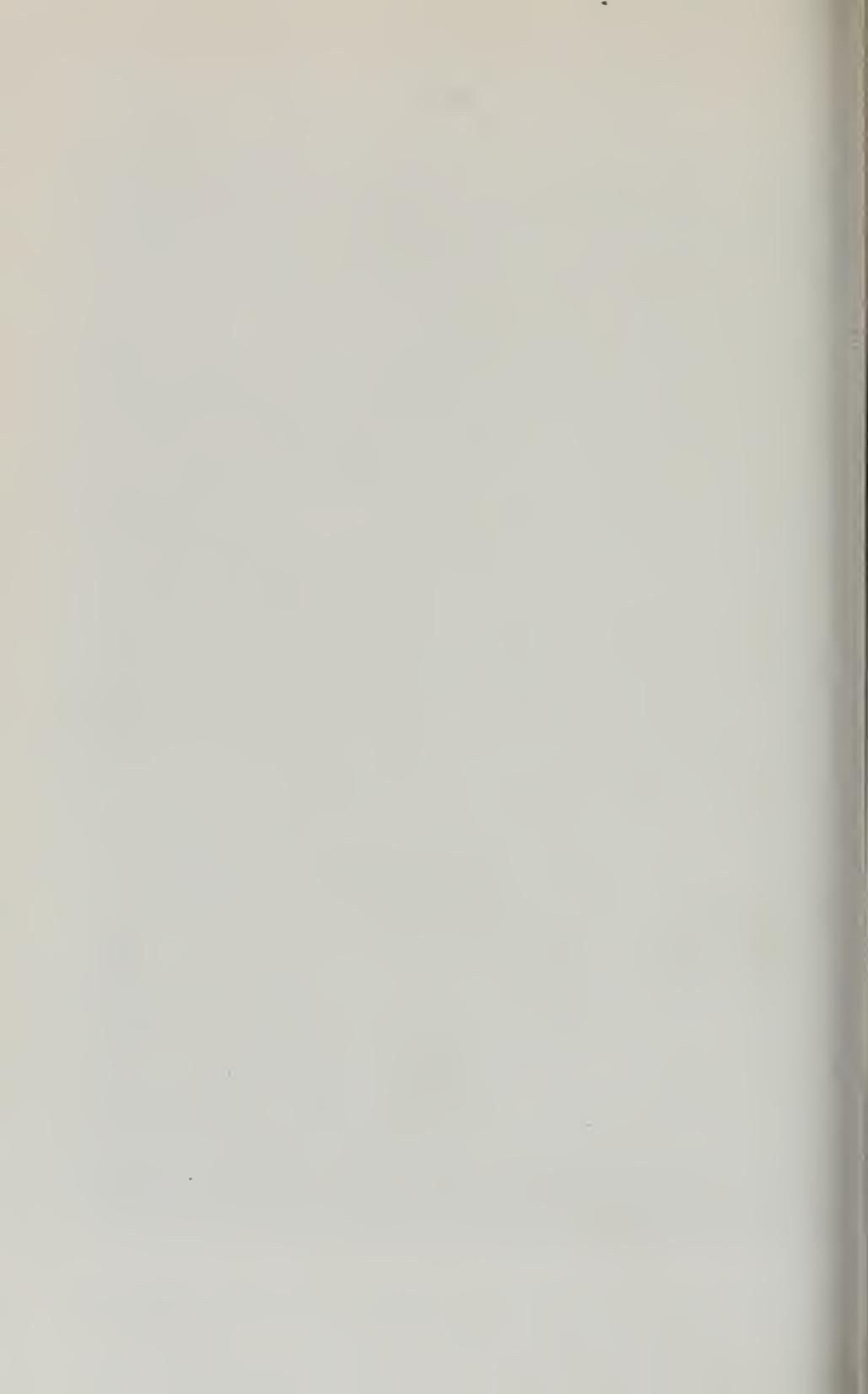
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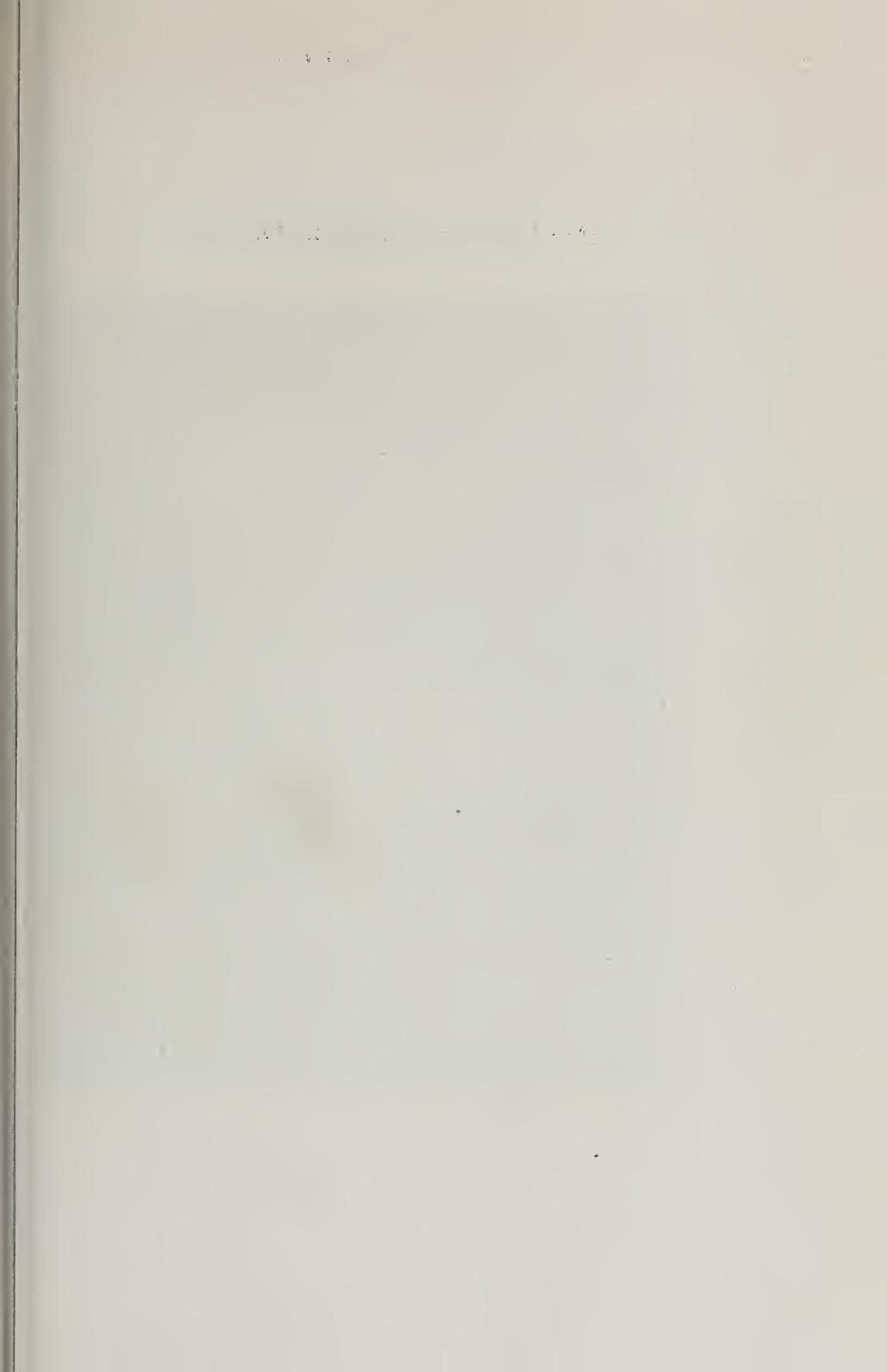


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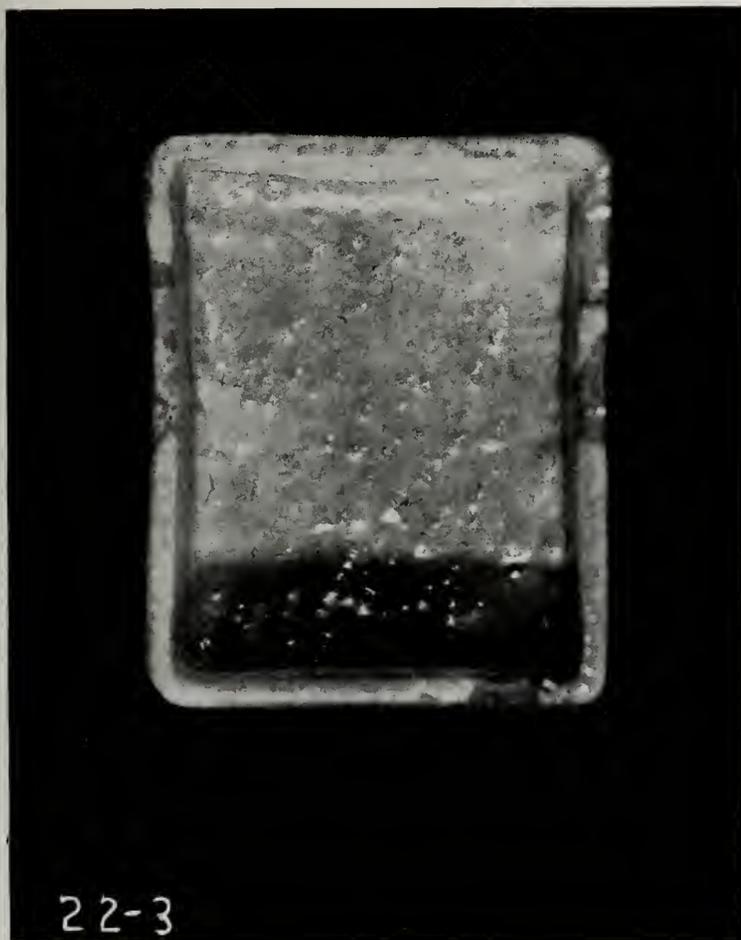




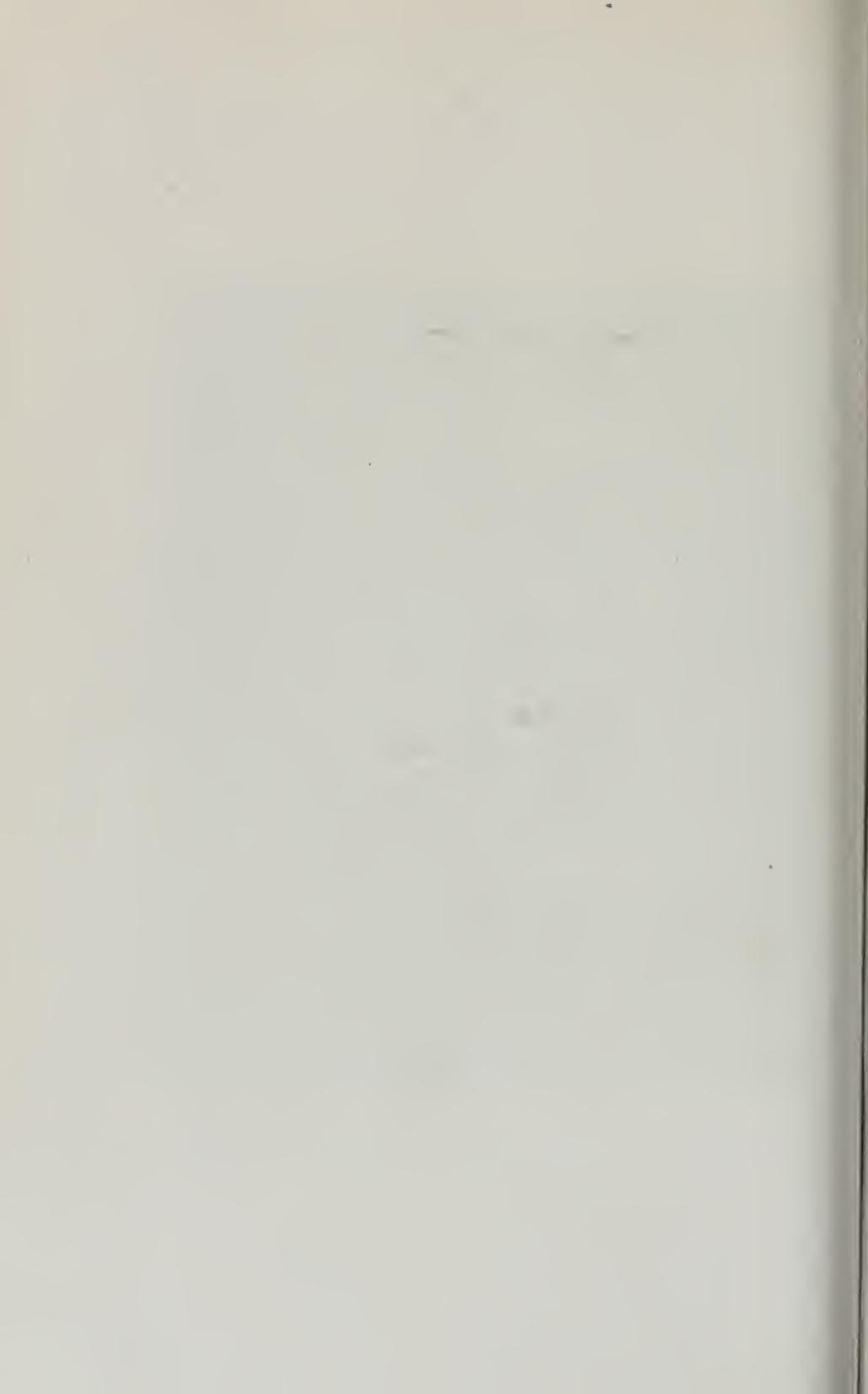
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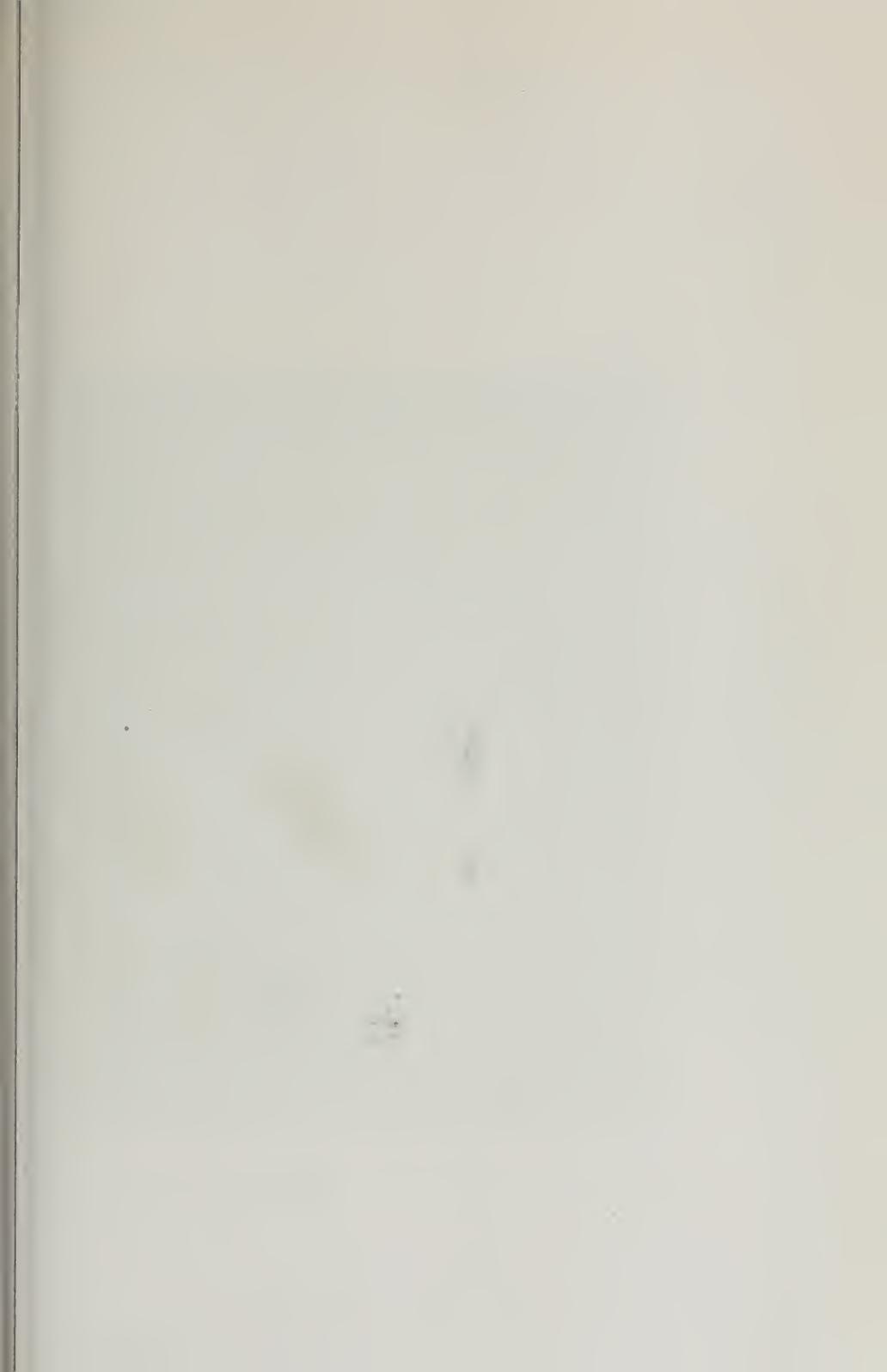
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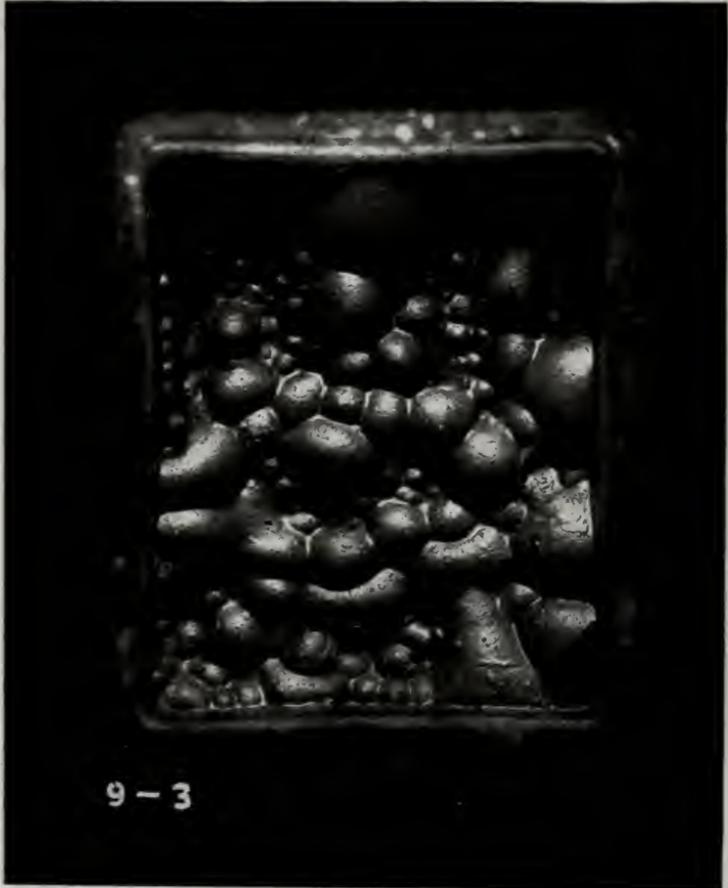
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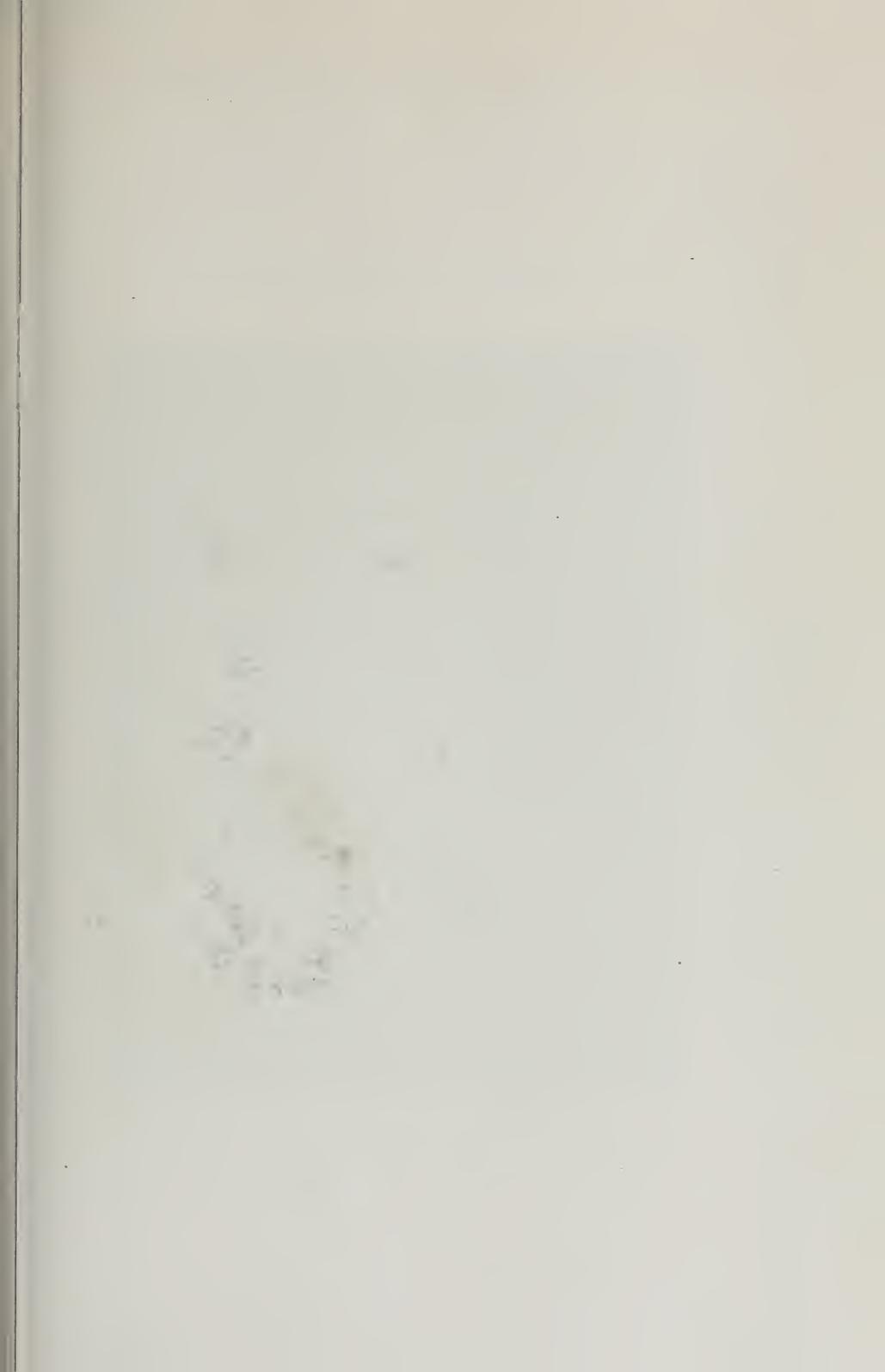
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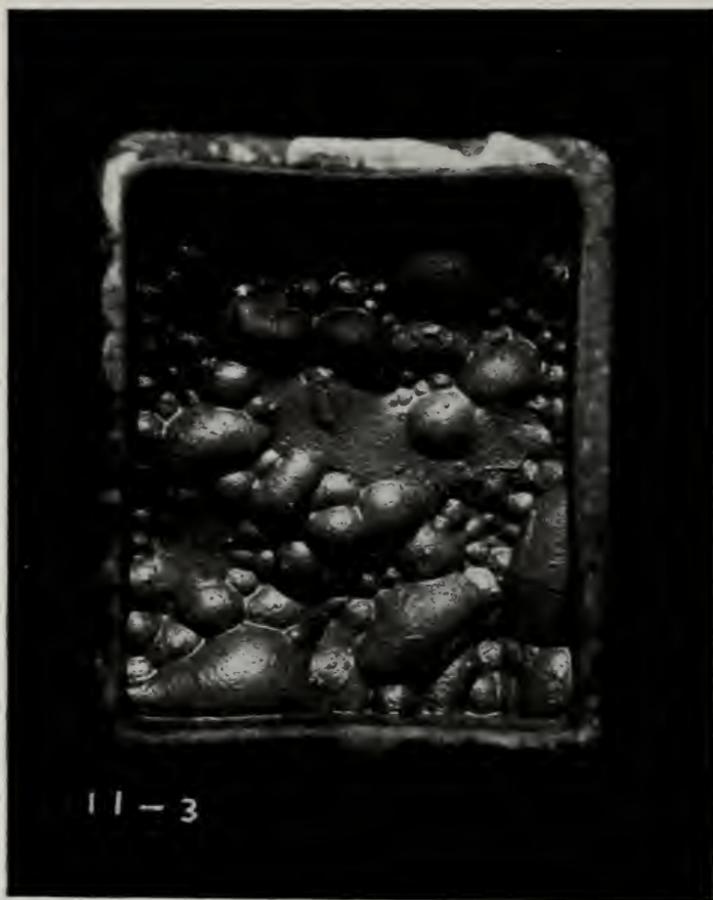


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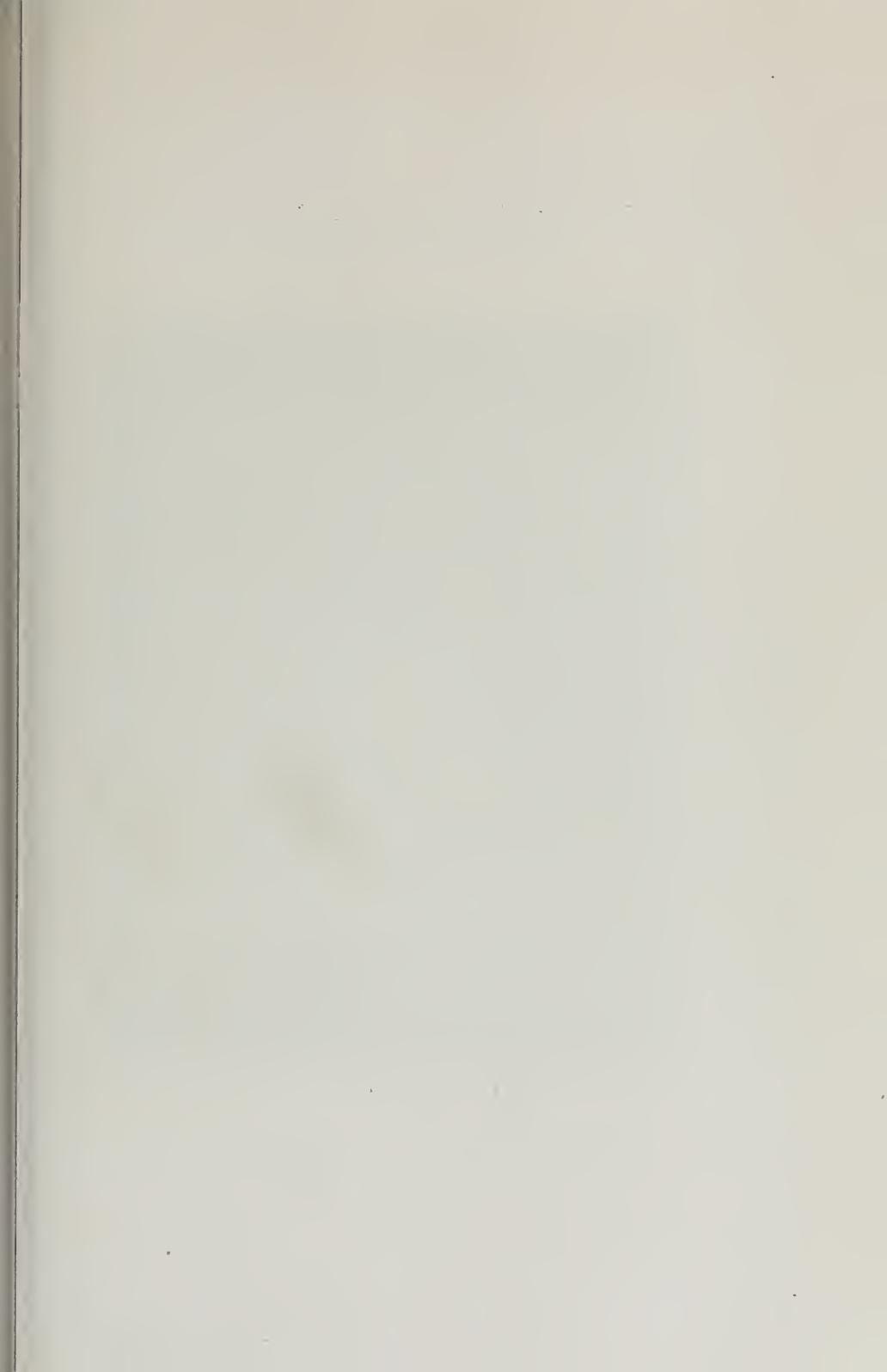
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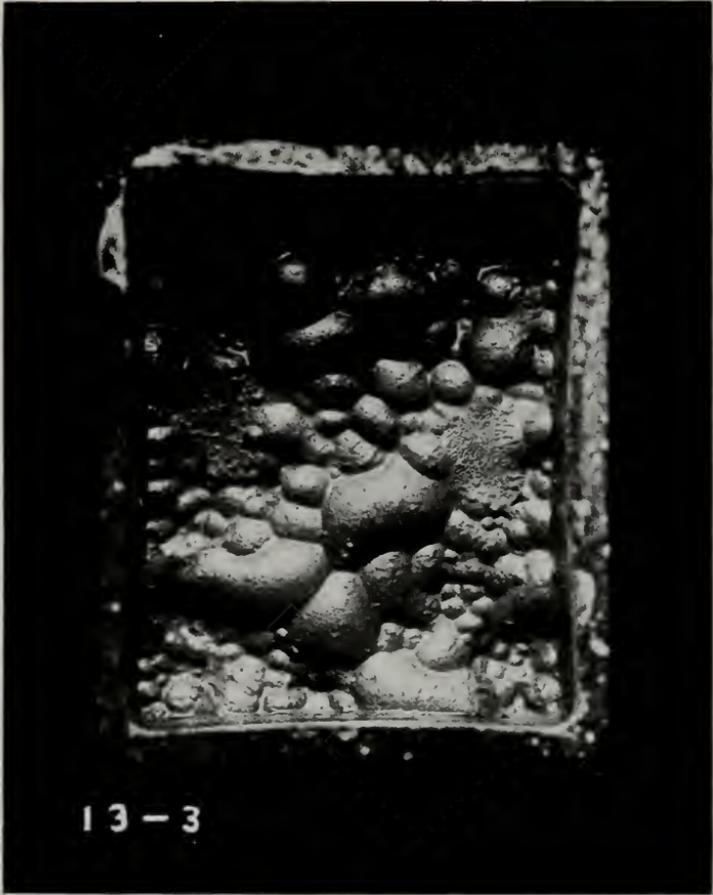


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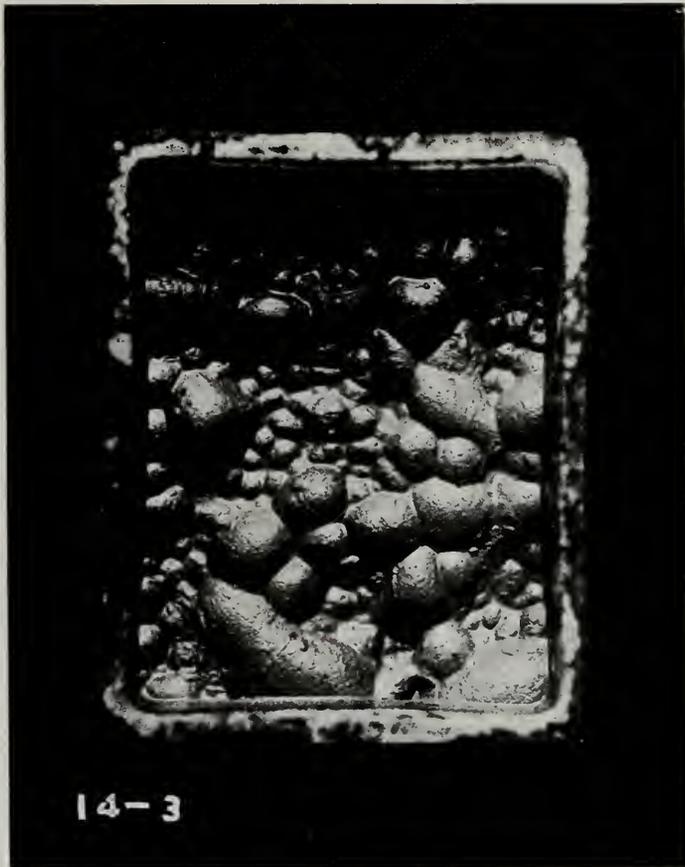


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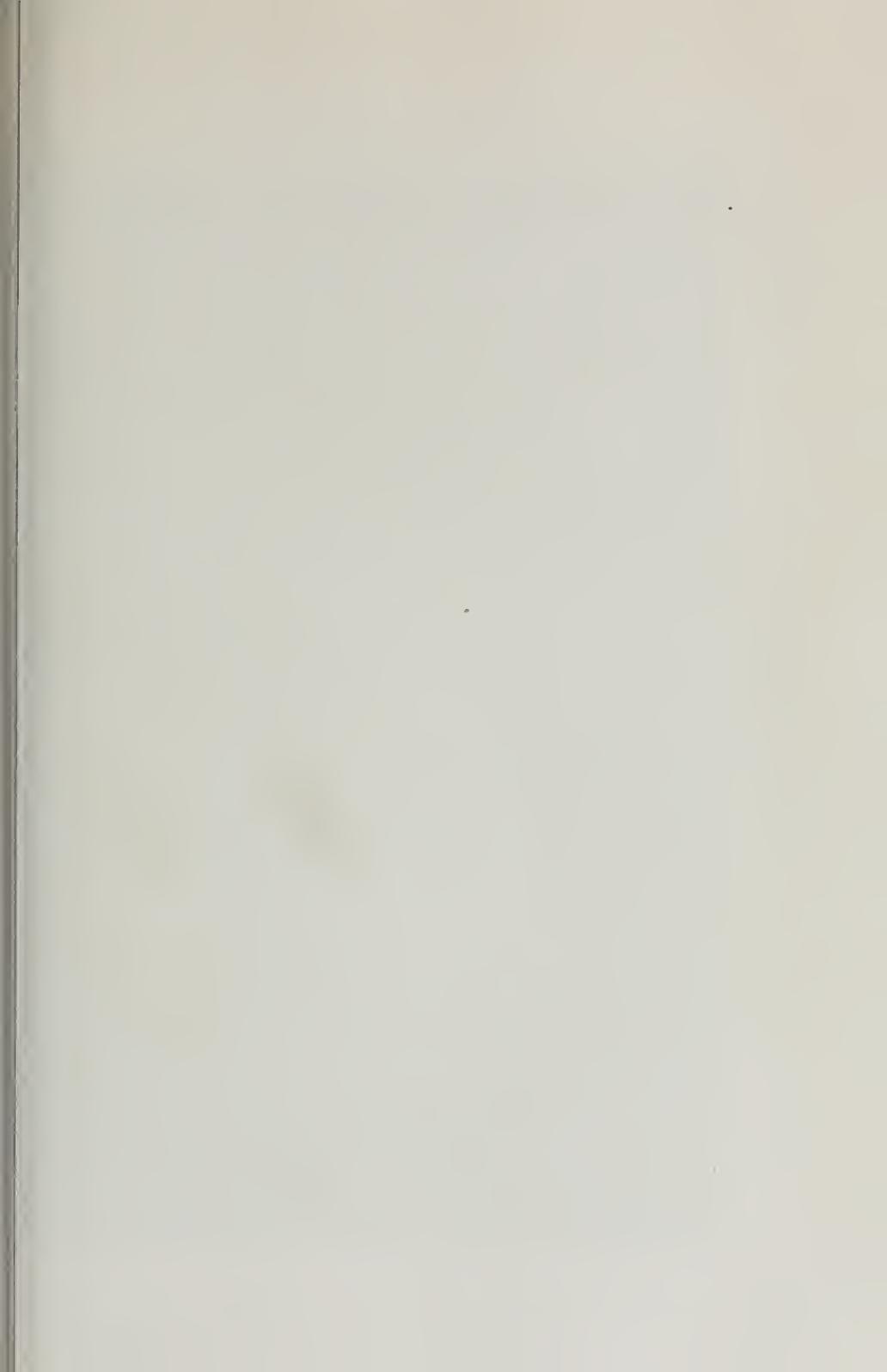


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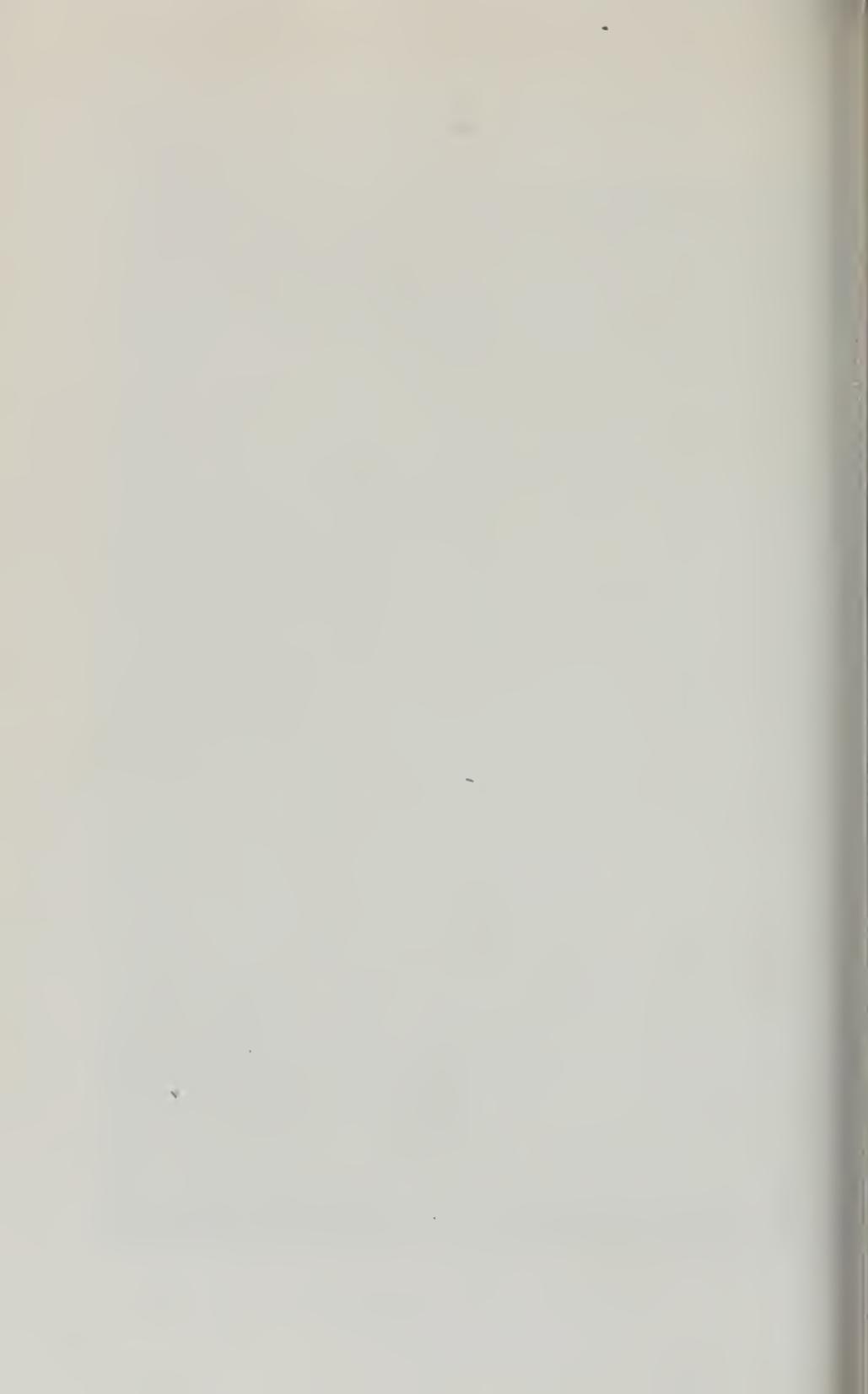


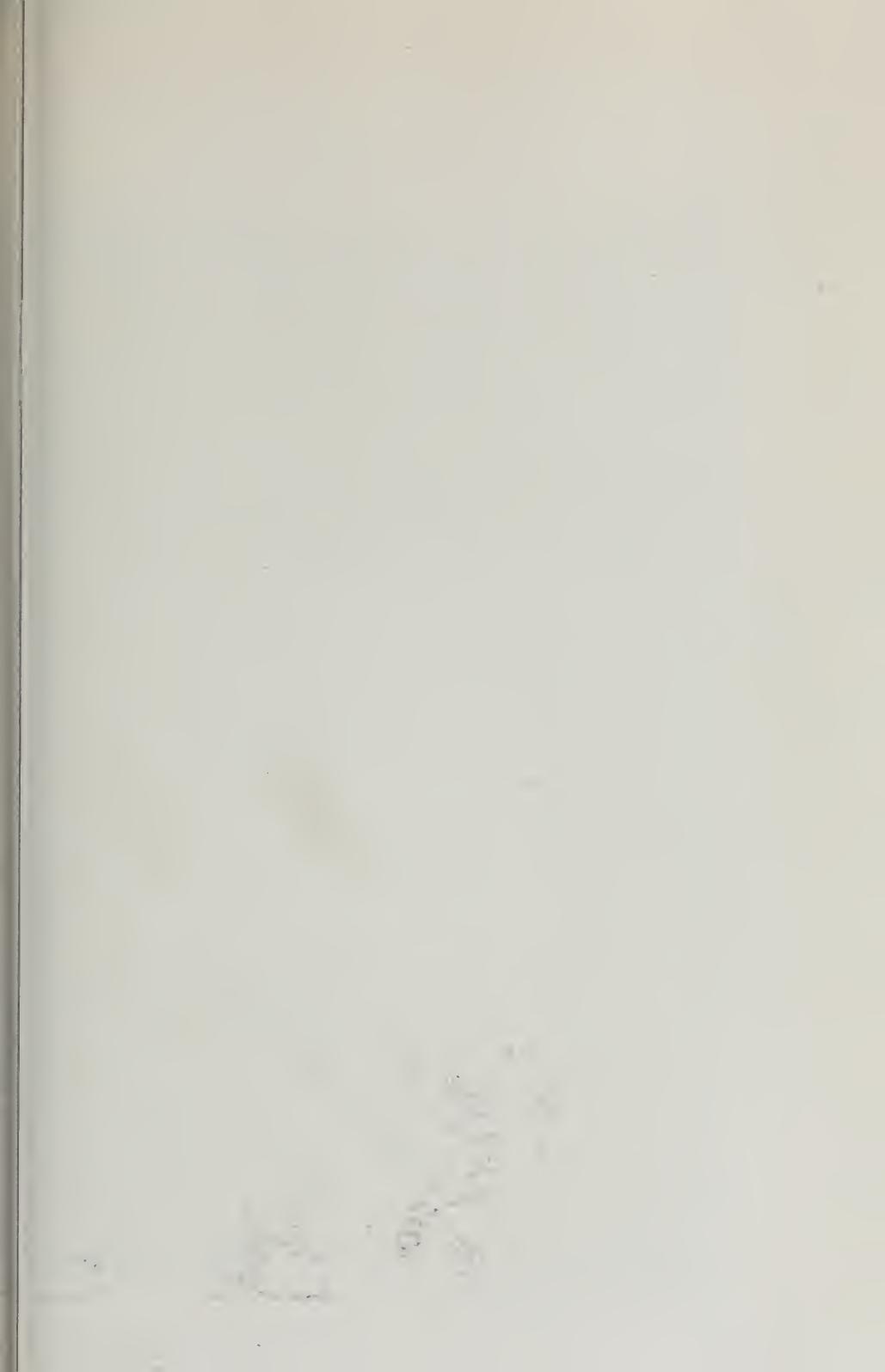
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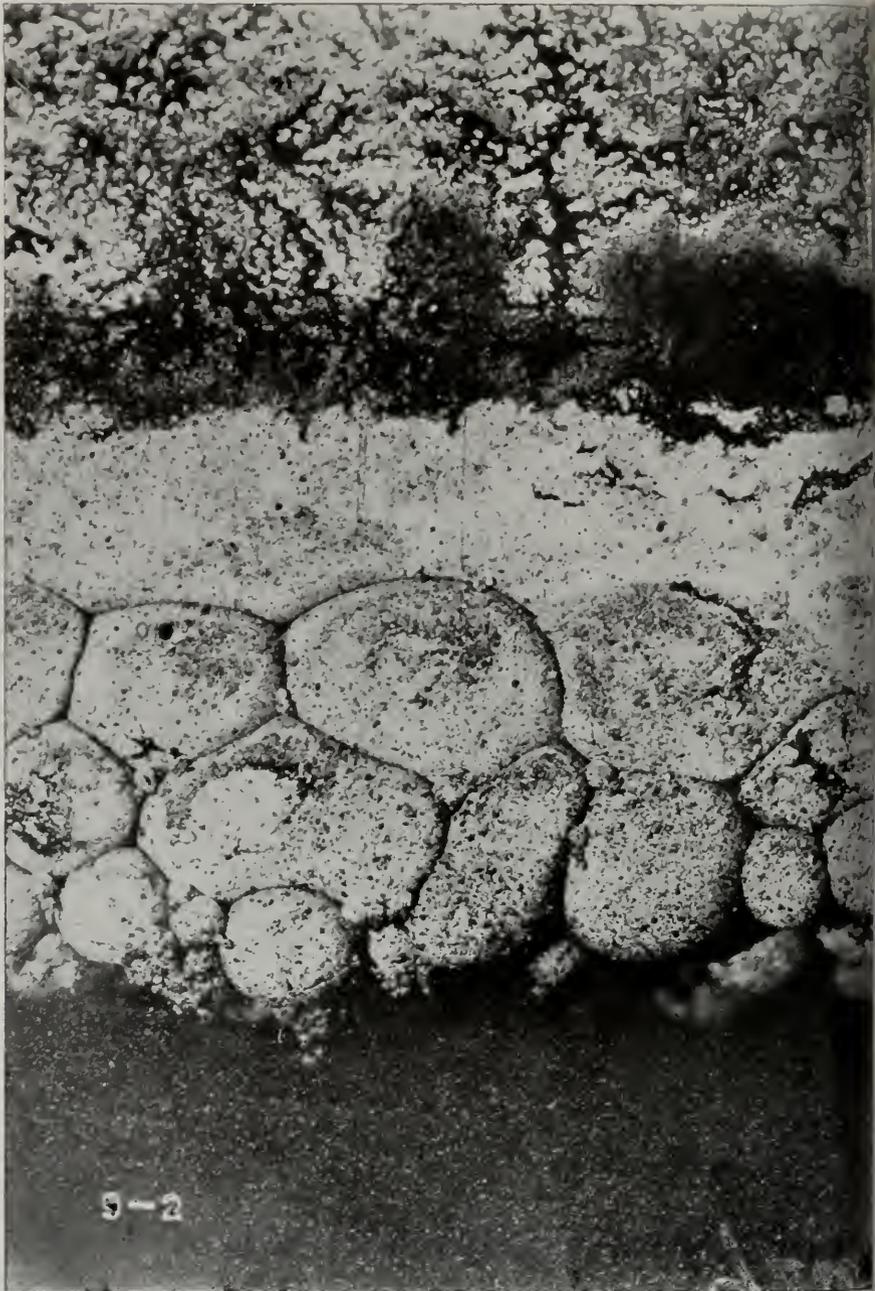


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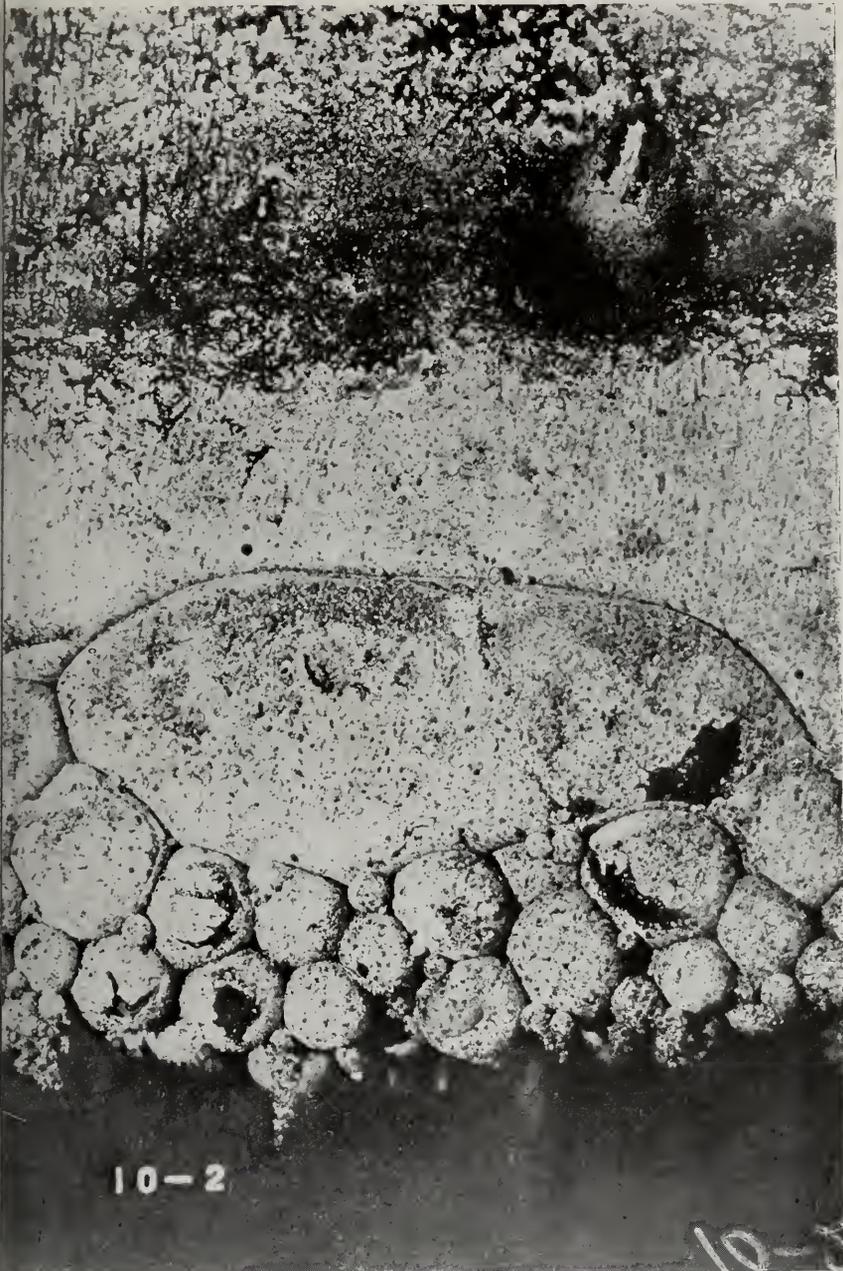




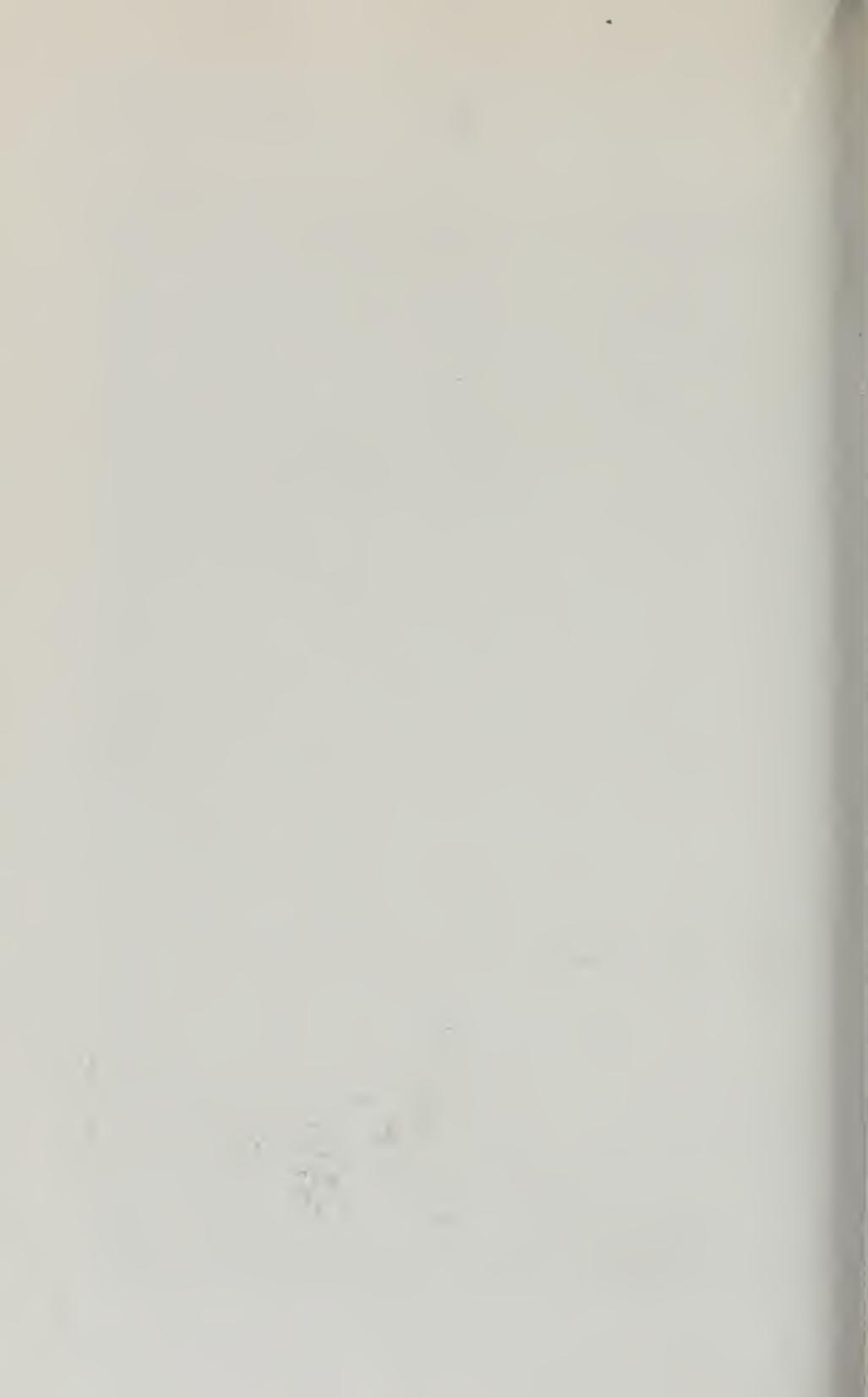
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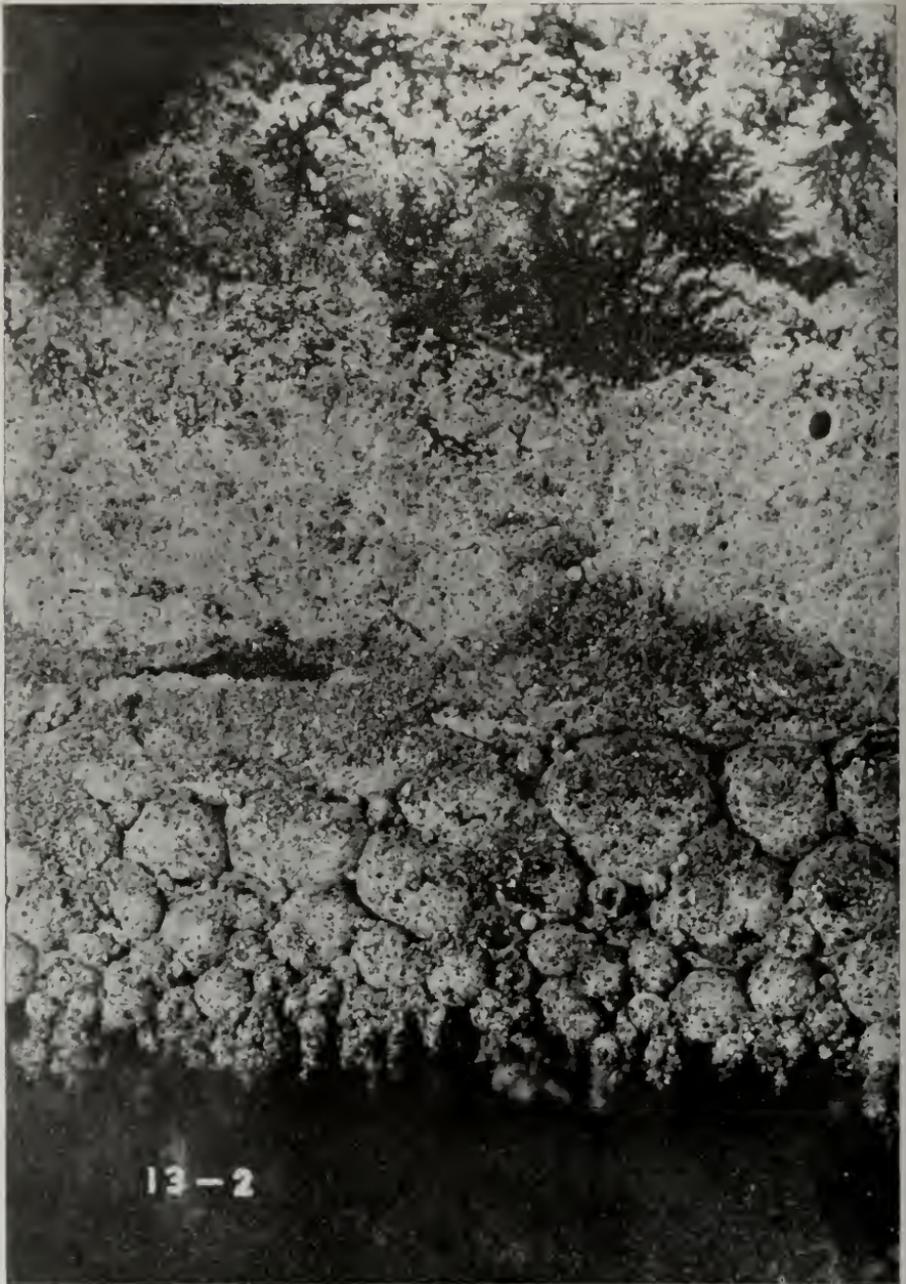


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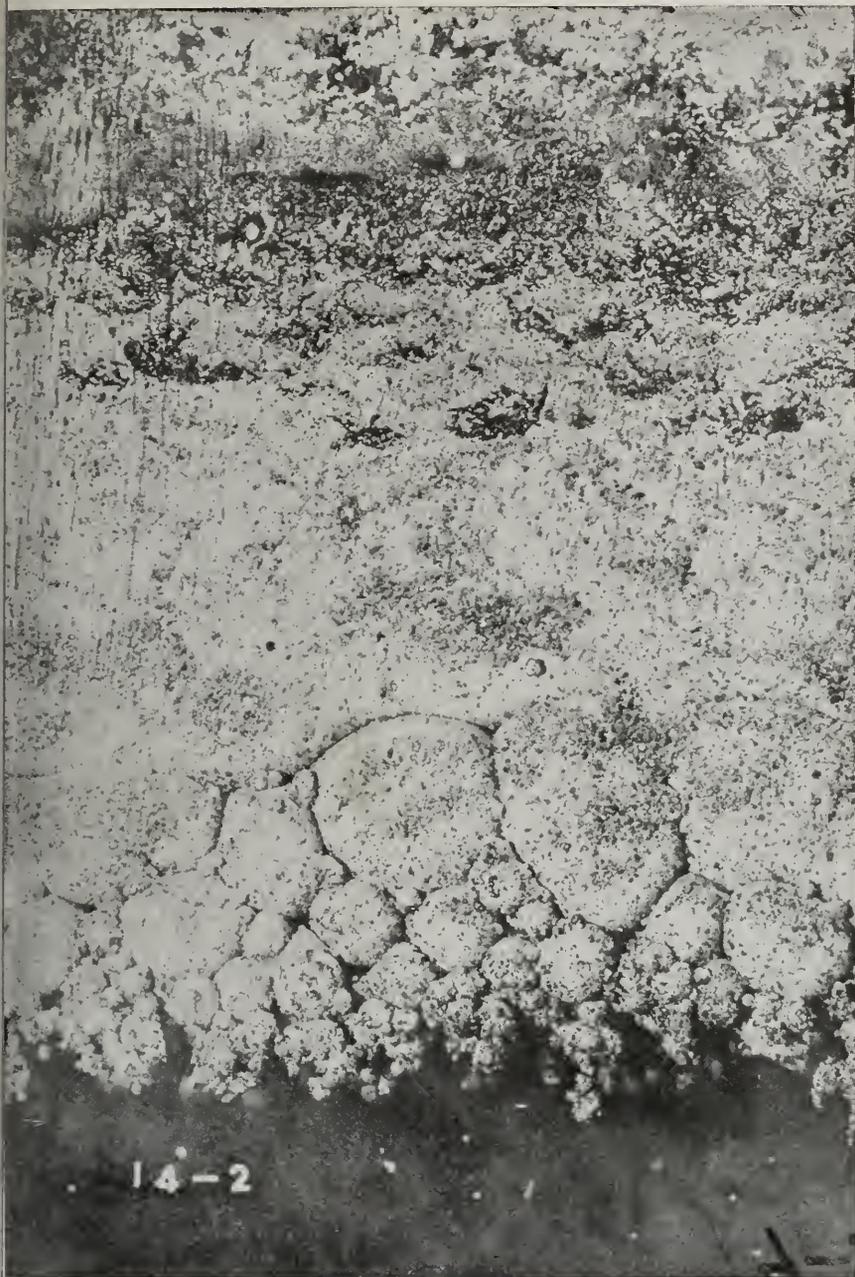




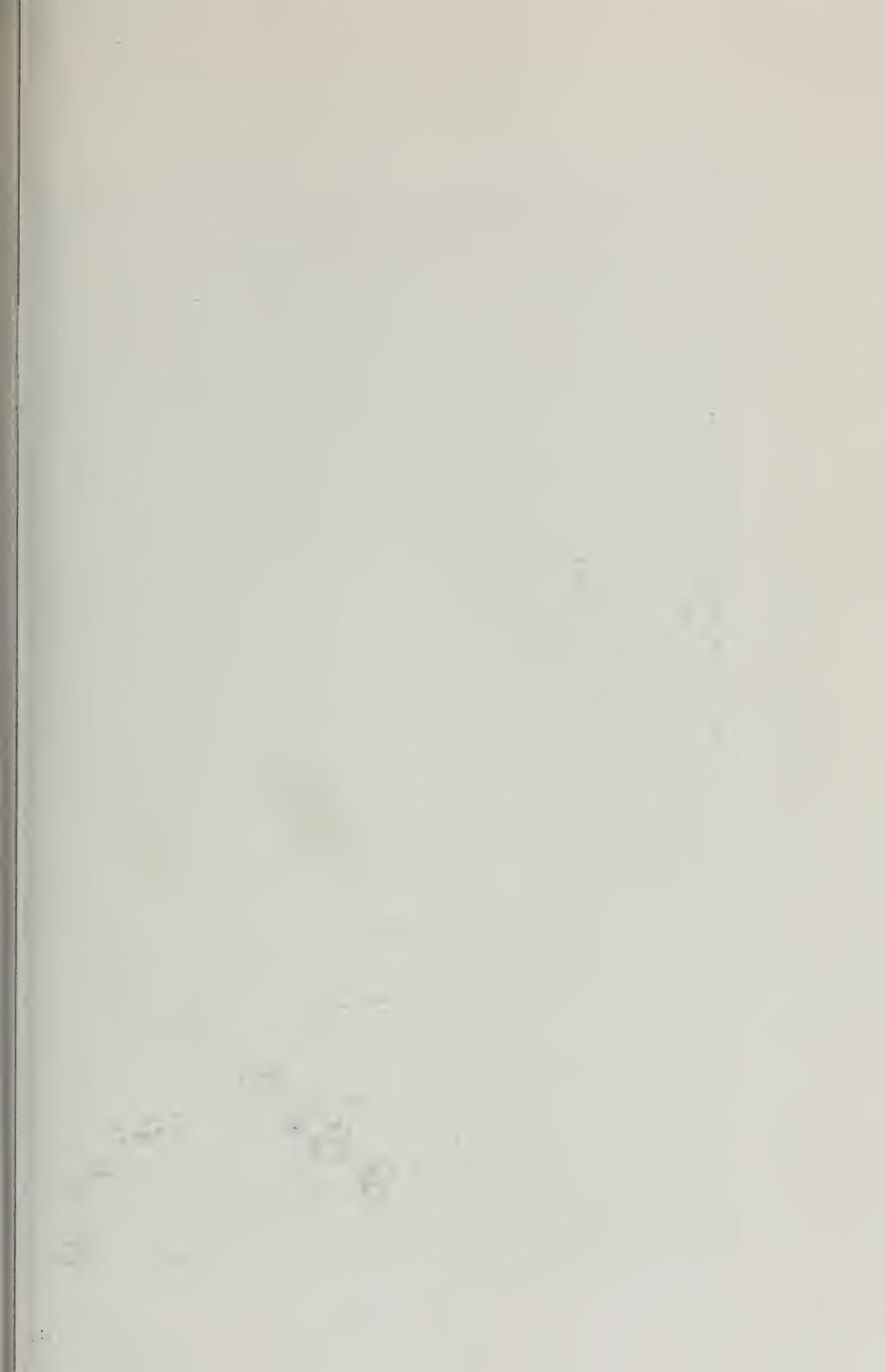
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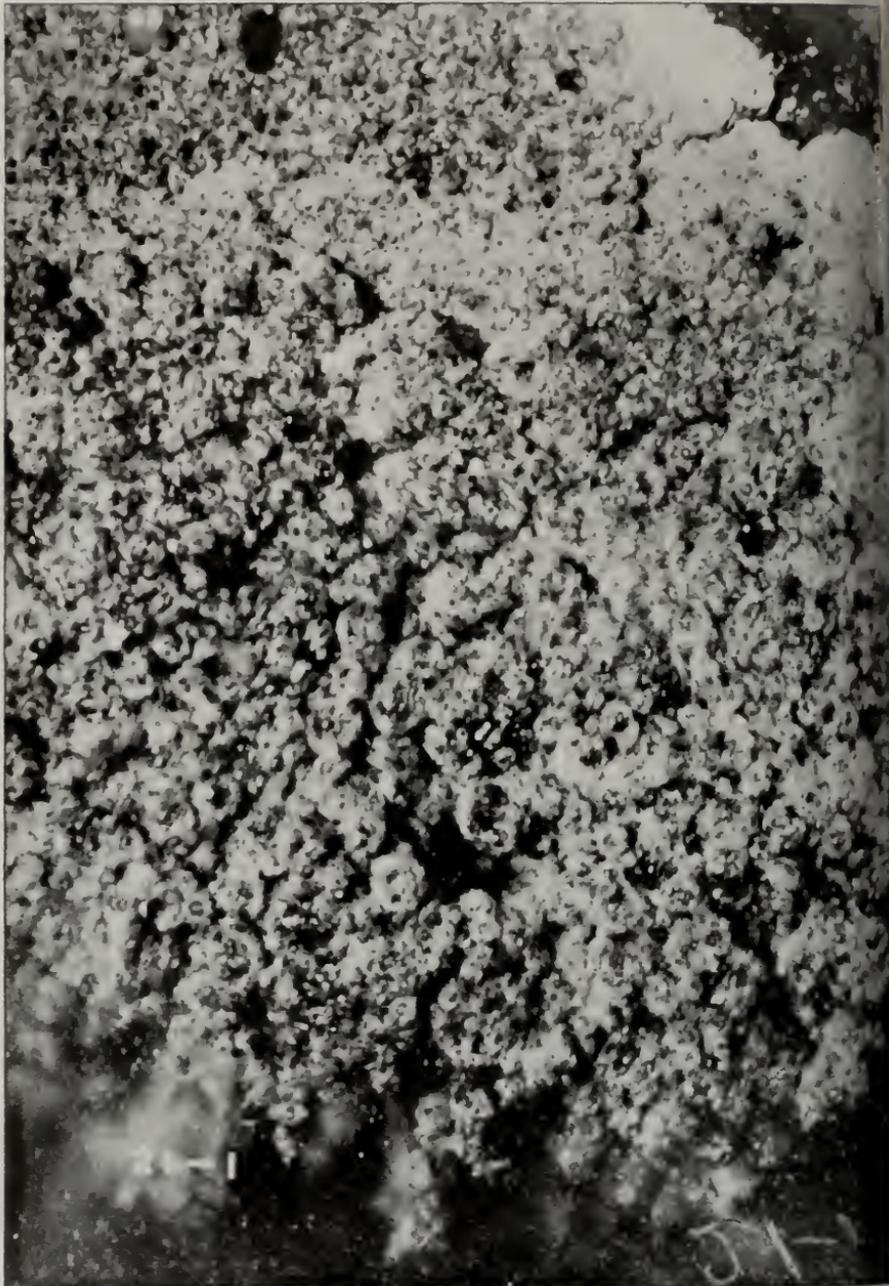
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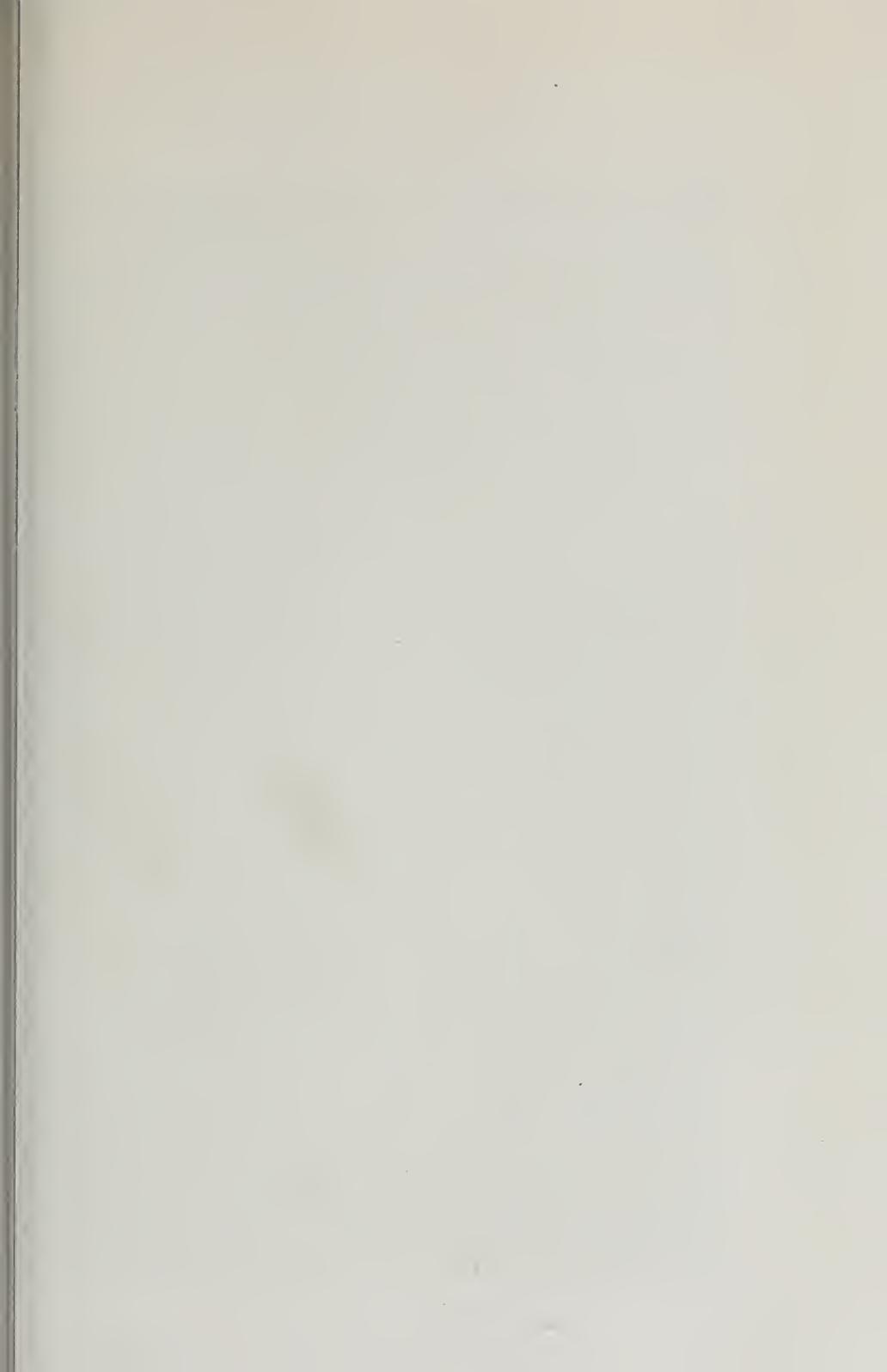


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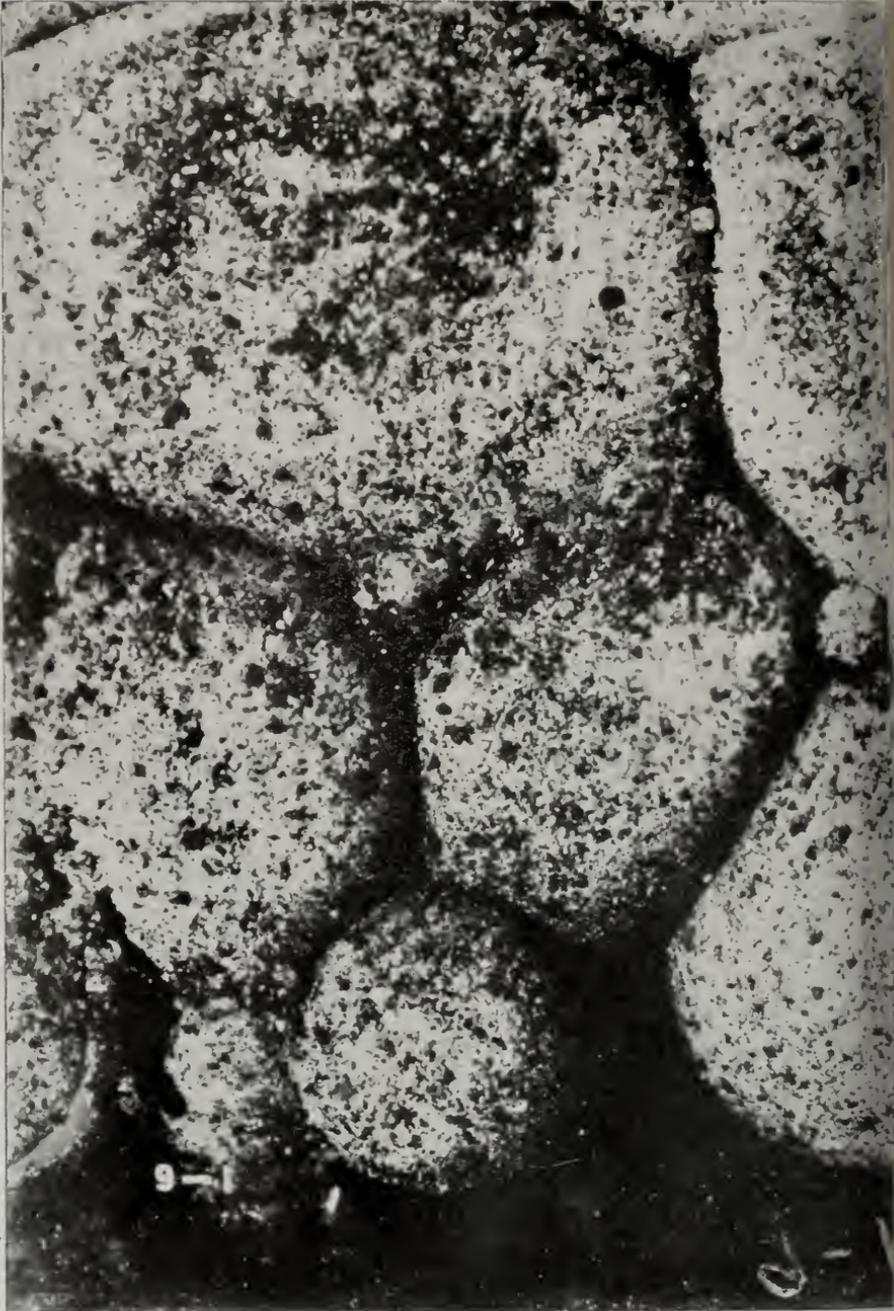
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Defendant's Exhibit No. 93.





Defendant's Exhibit No. 94.



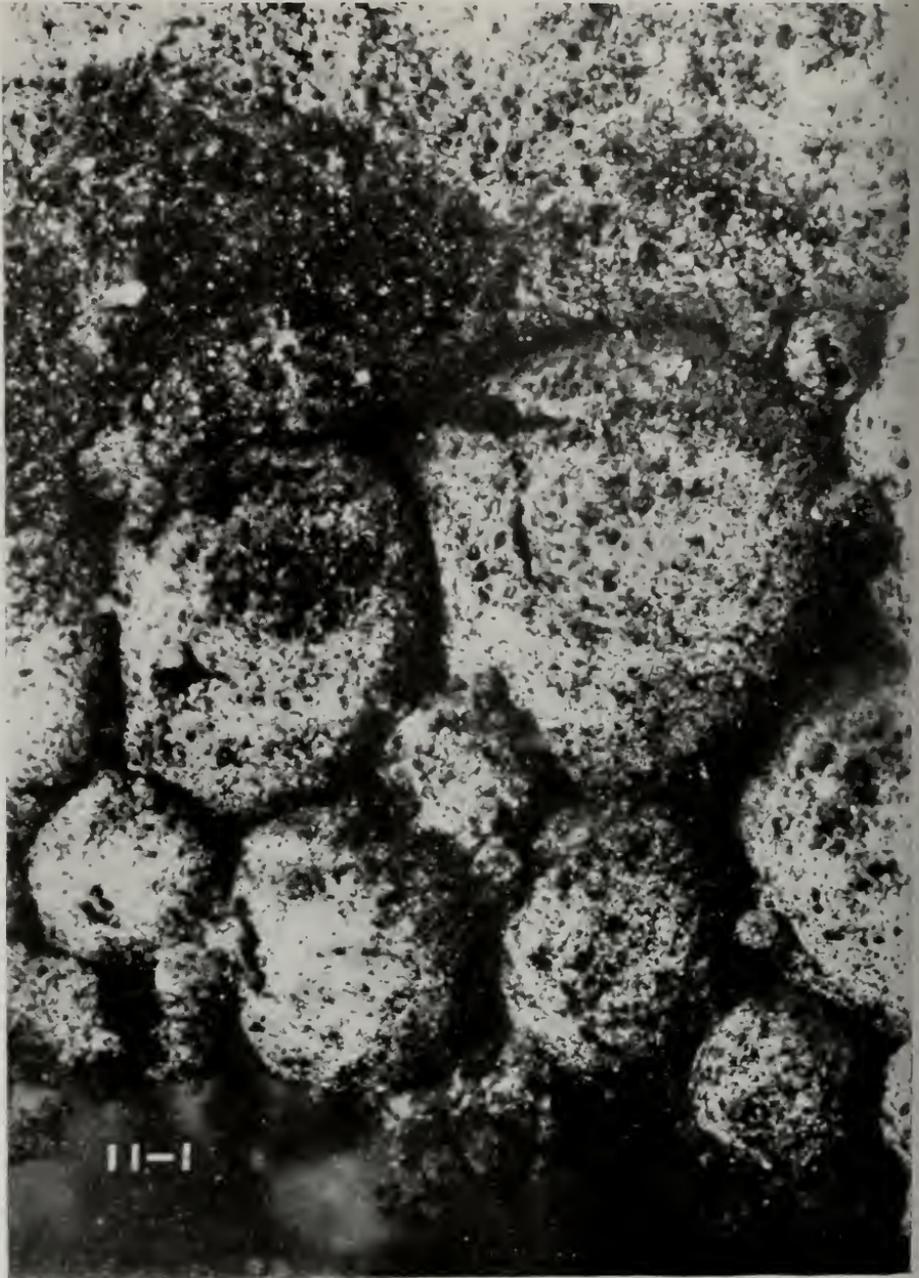
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Defendant's Exhibit No. 95.





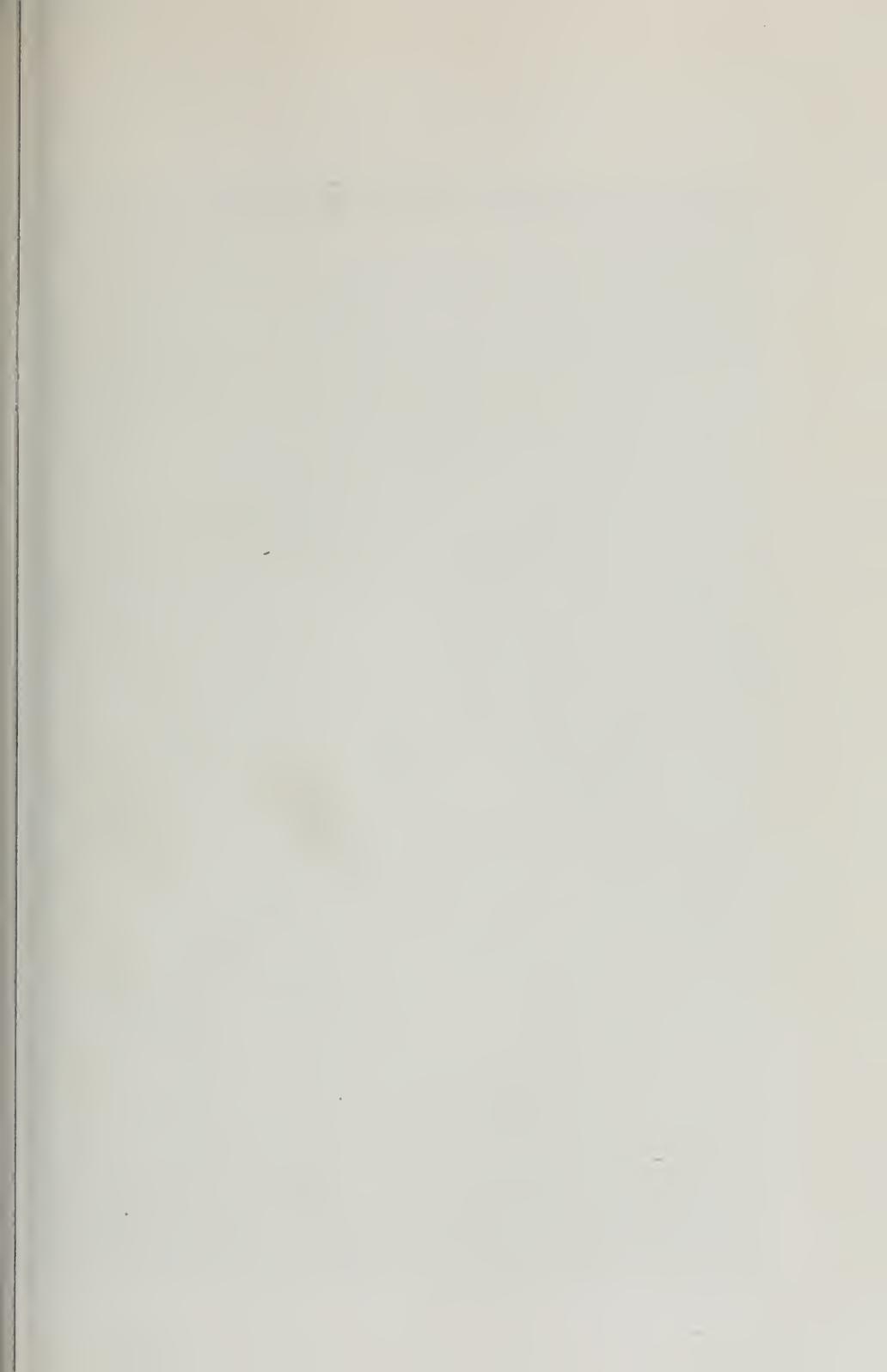
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Defendant's Exhibit No. 97.





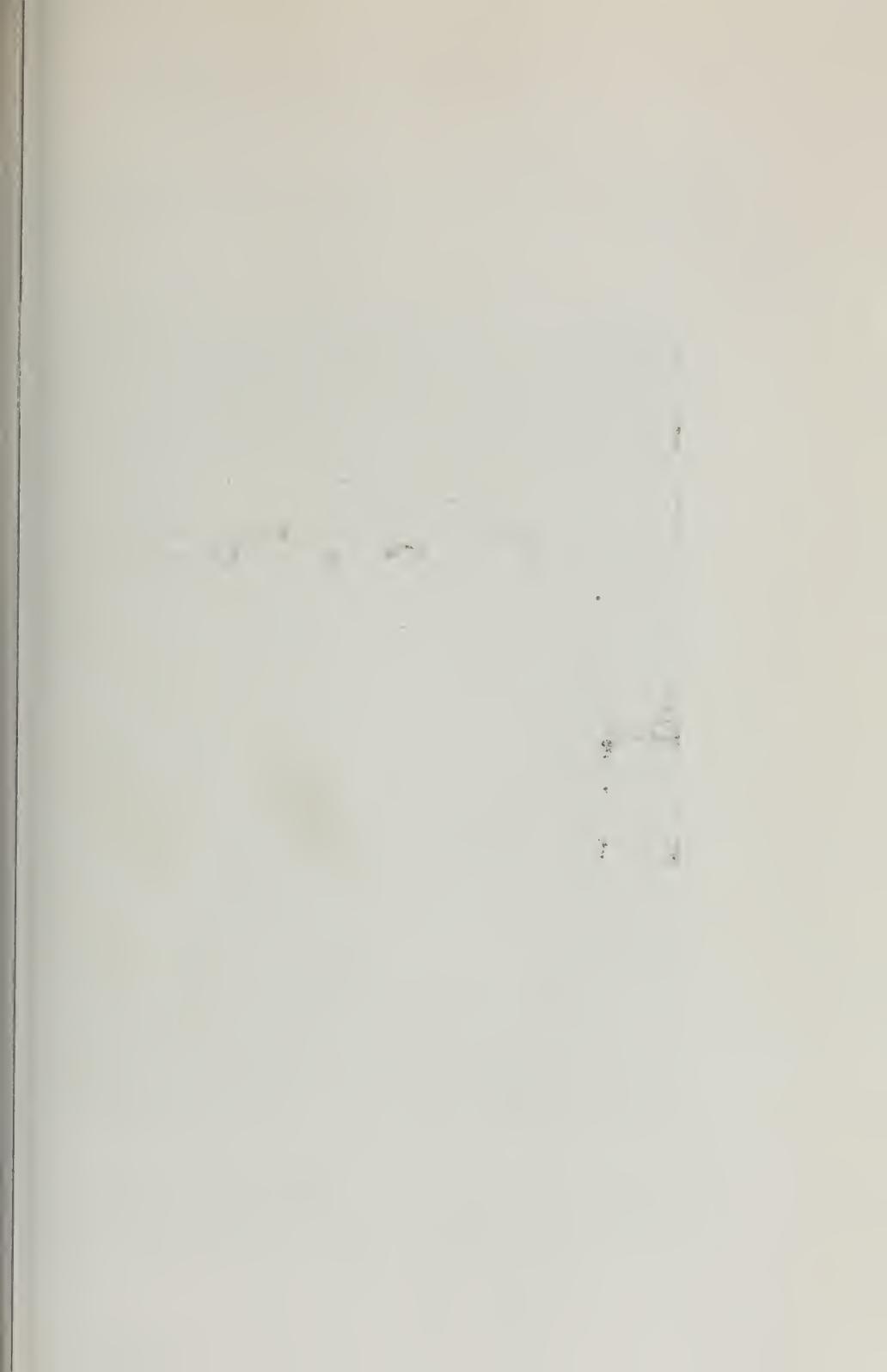
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Defendant's Exhibit No. 99.



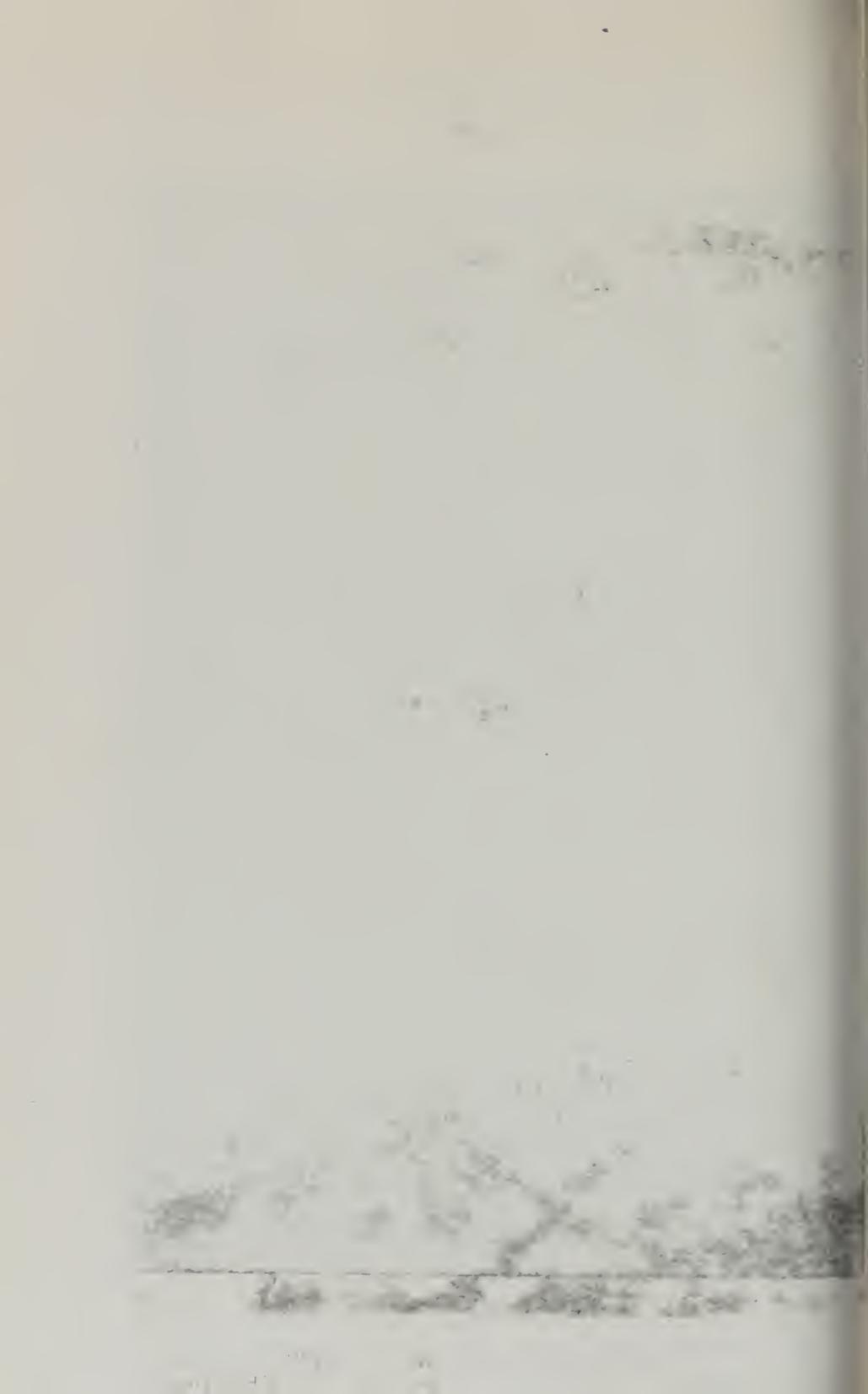


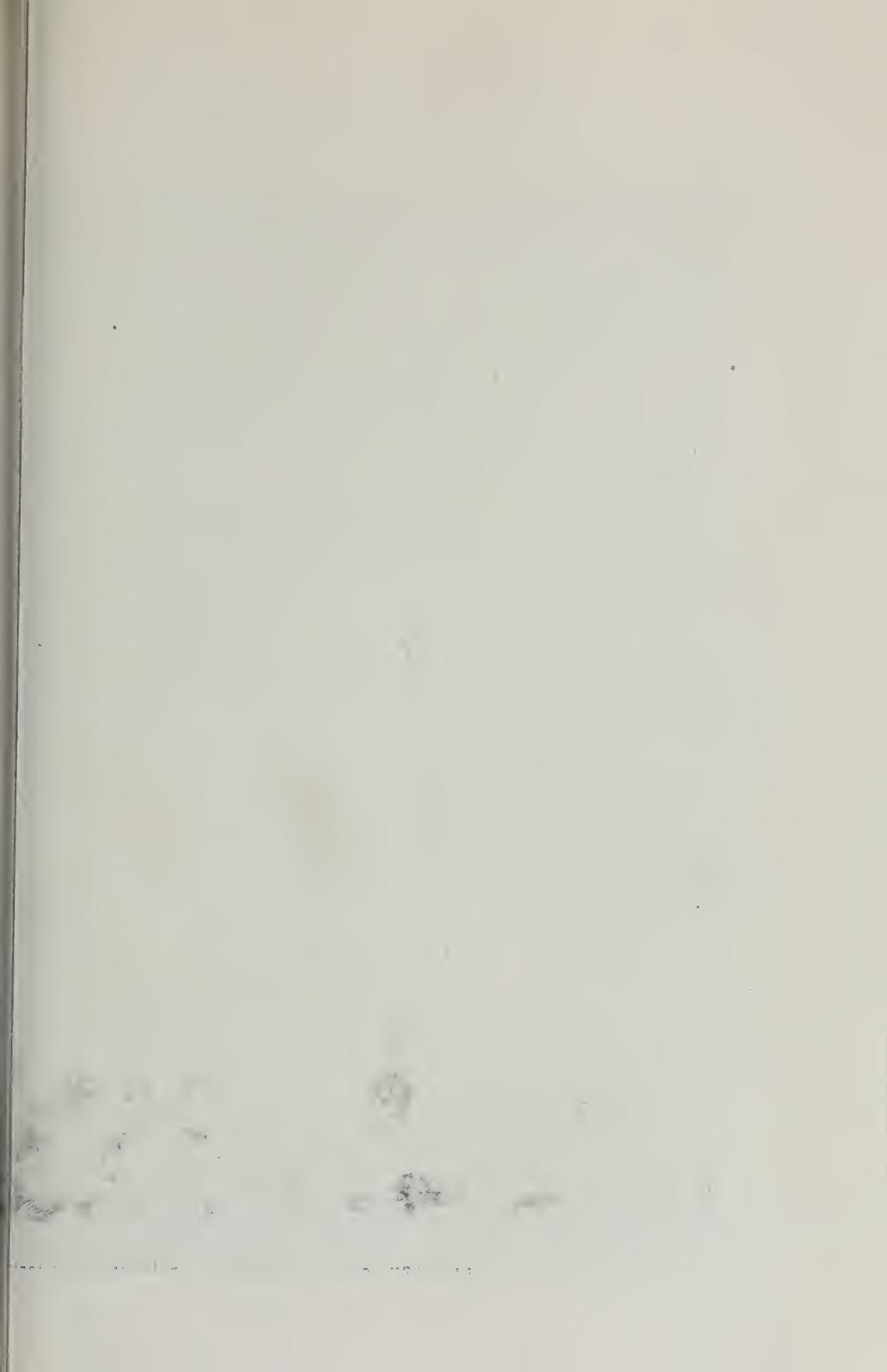
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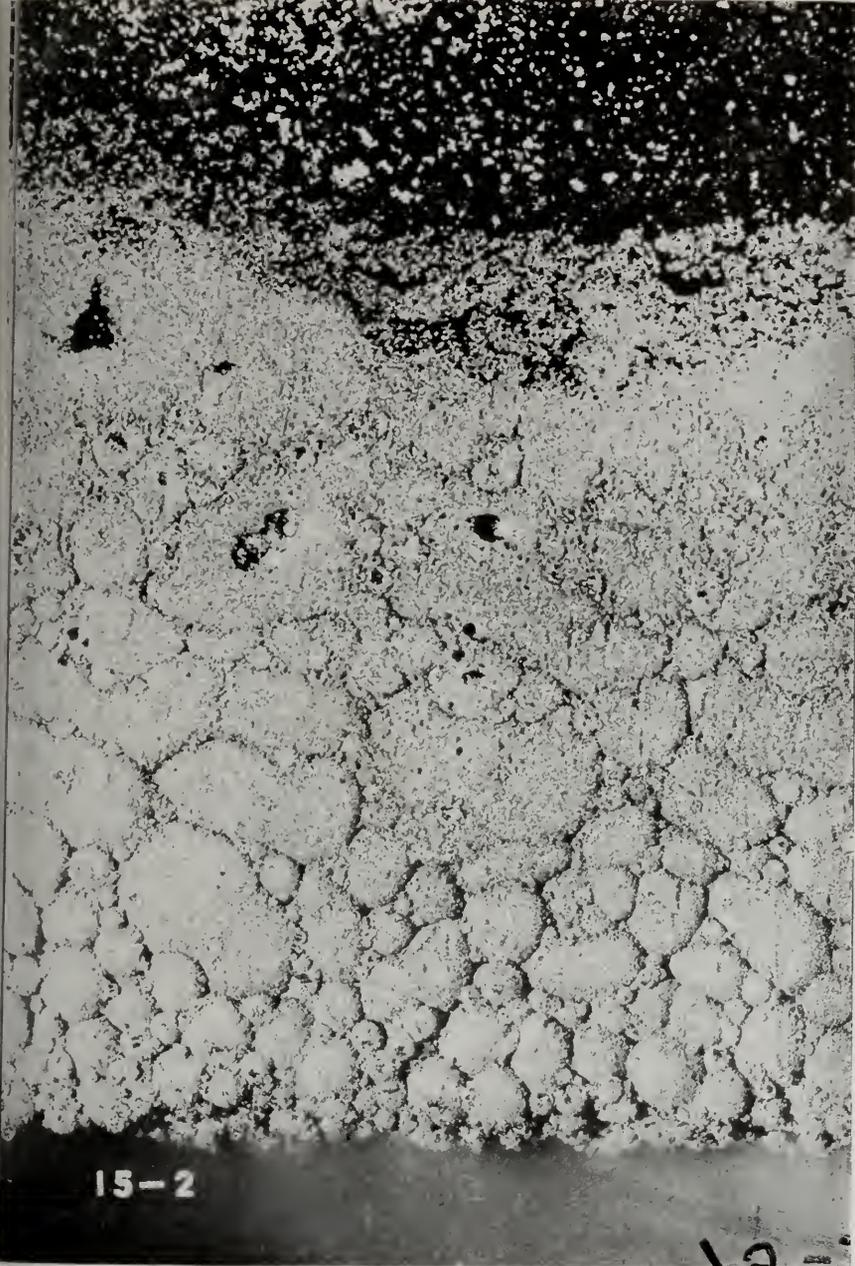
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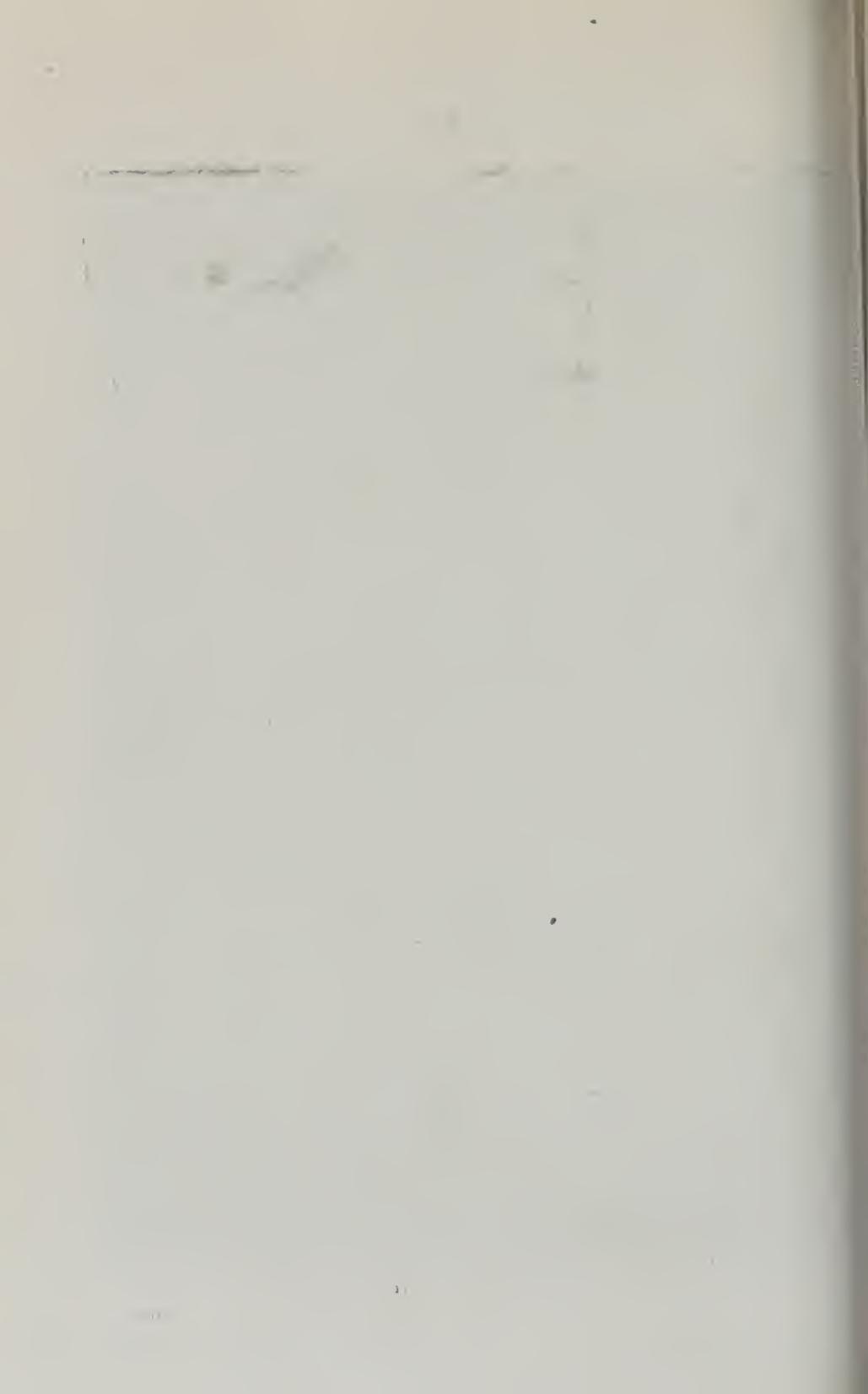


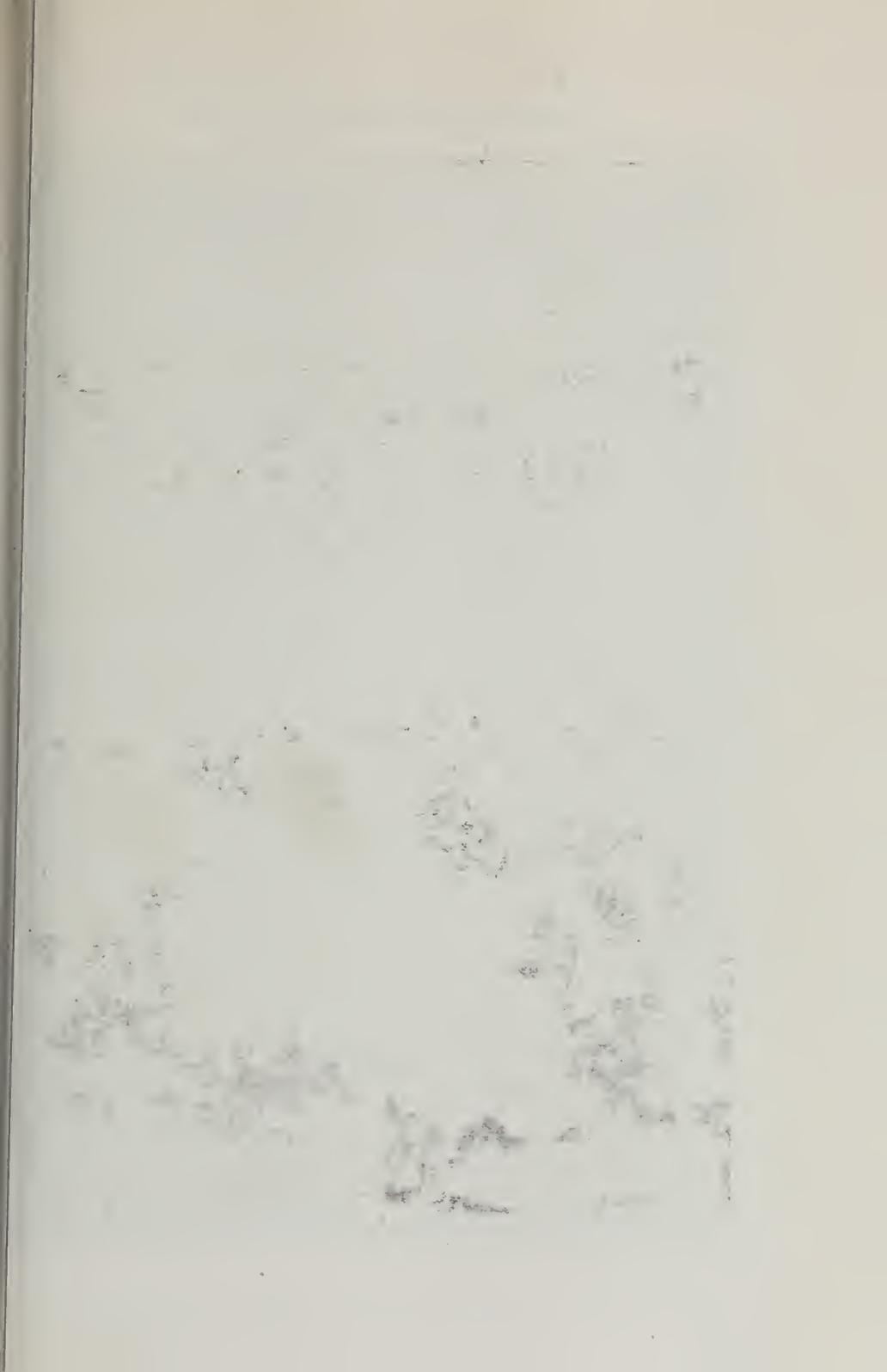
Filed May 18, 19

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 103.







Defendant's Exhibit No. 104.

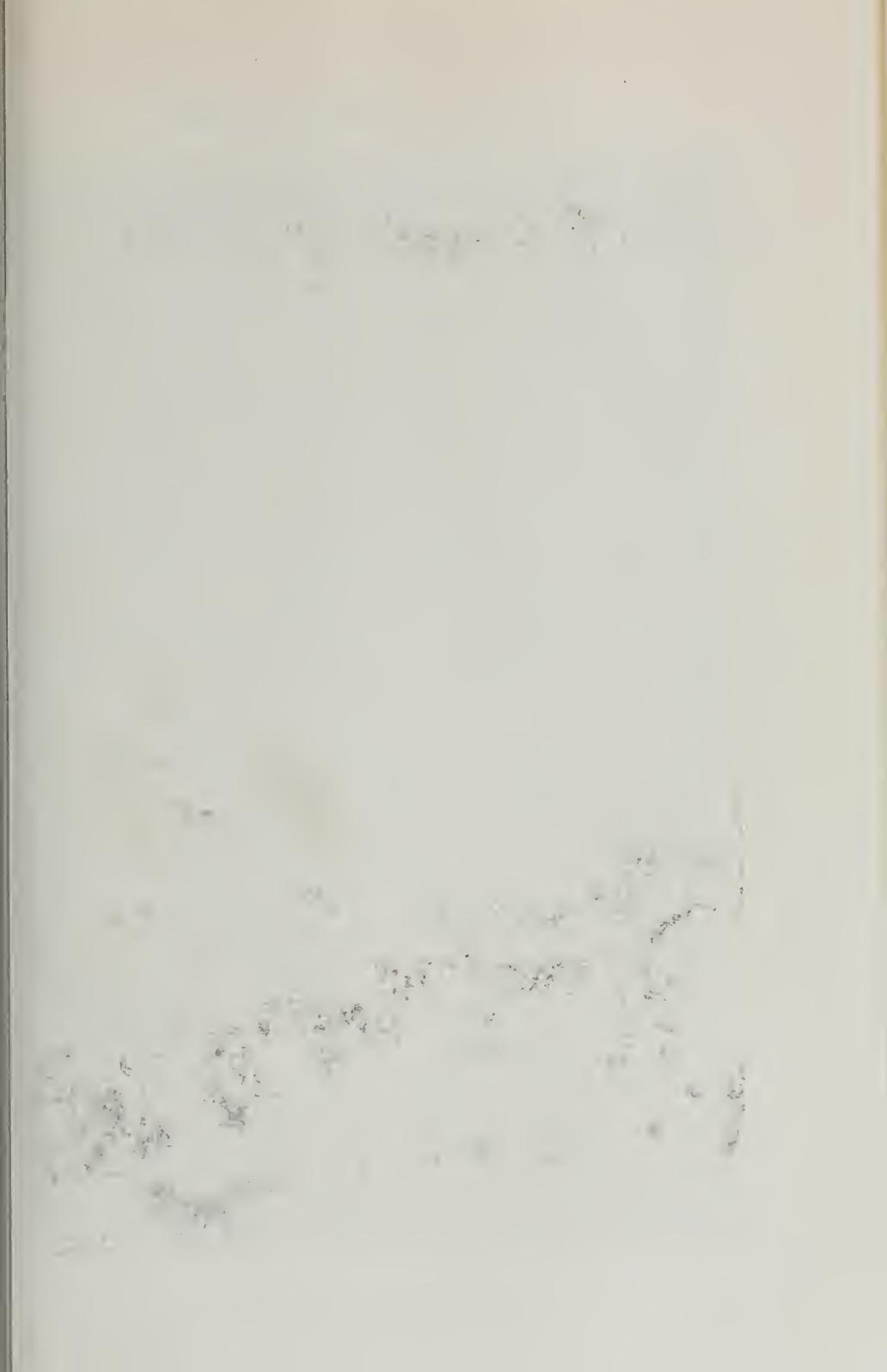


Filed May 18, 1917.

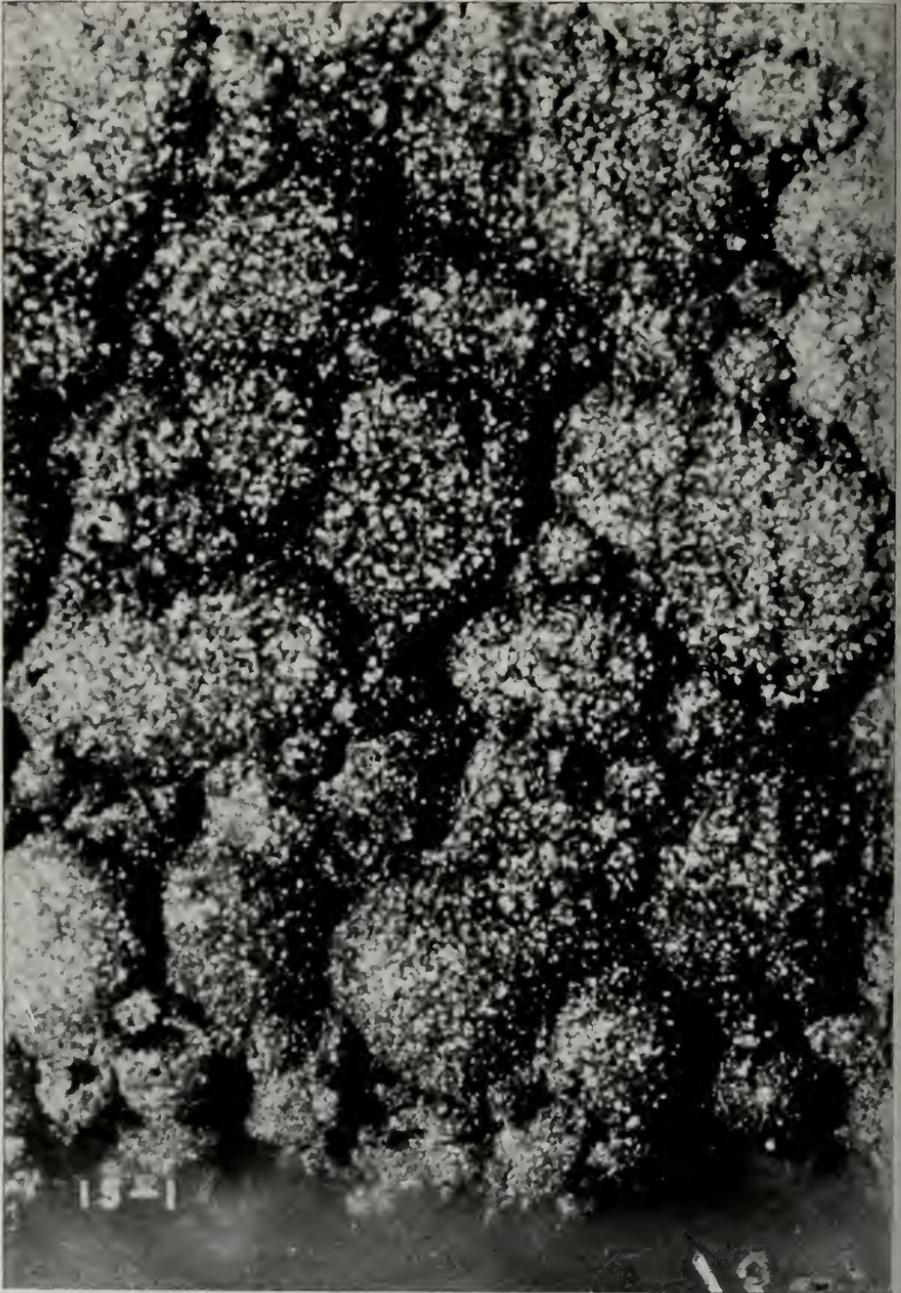
W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 105.



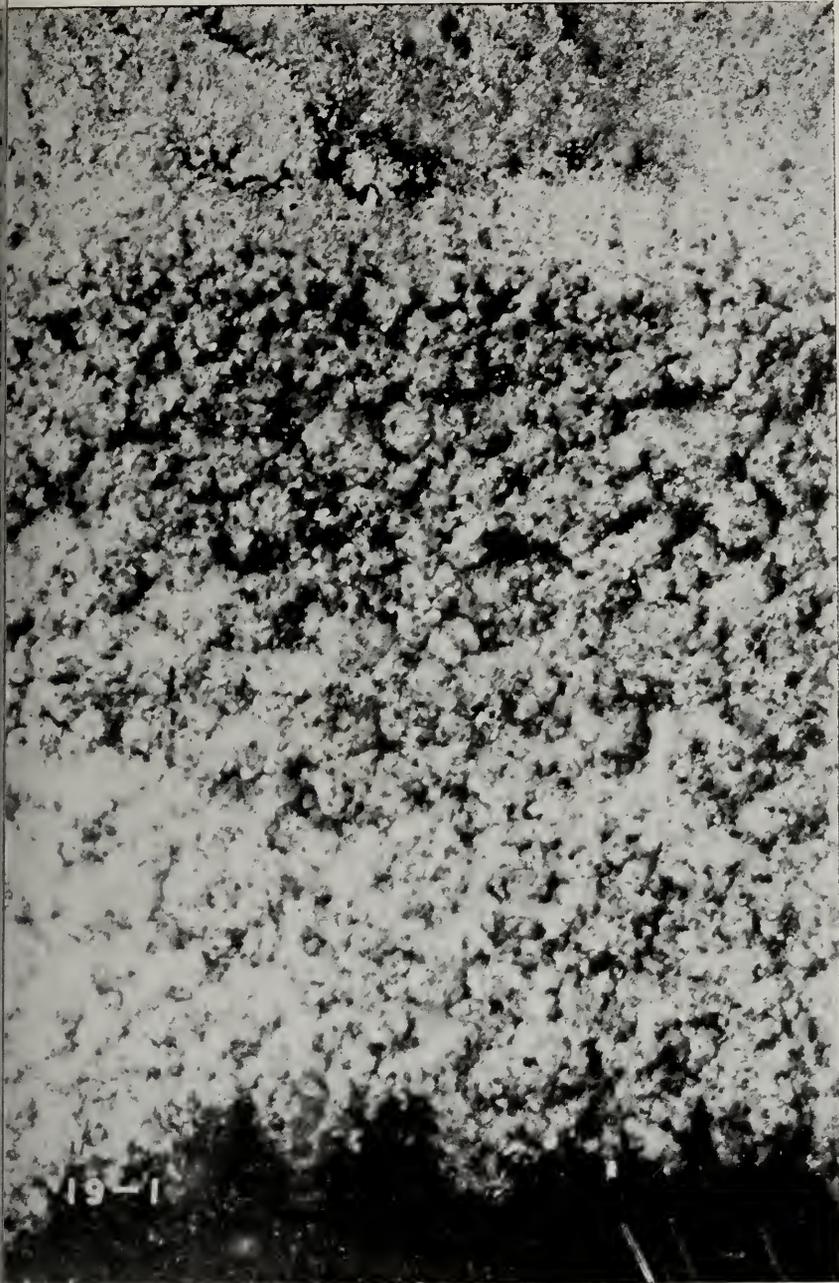


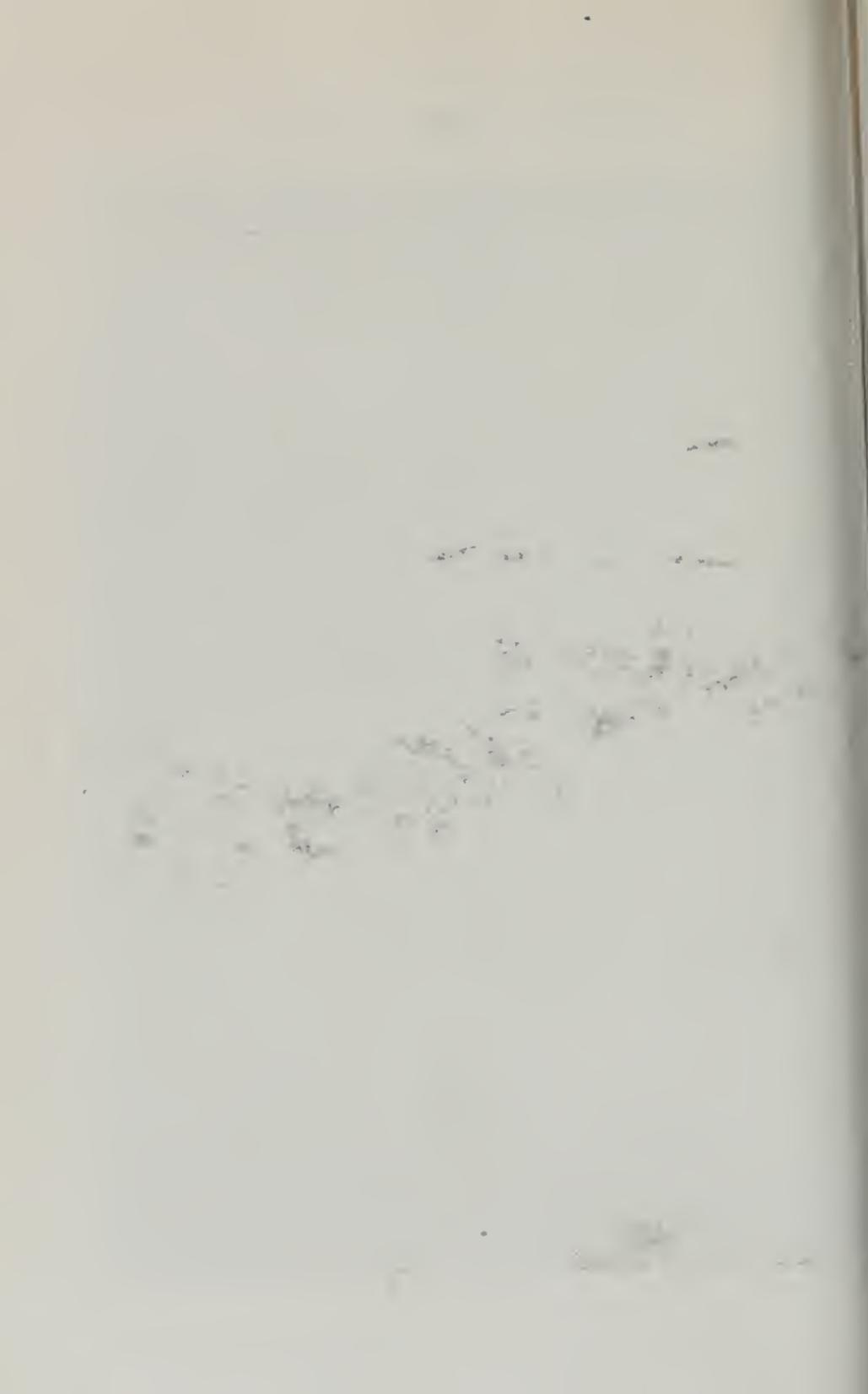
Defendant's Exhibit No. 106.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 107.



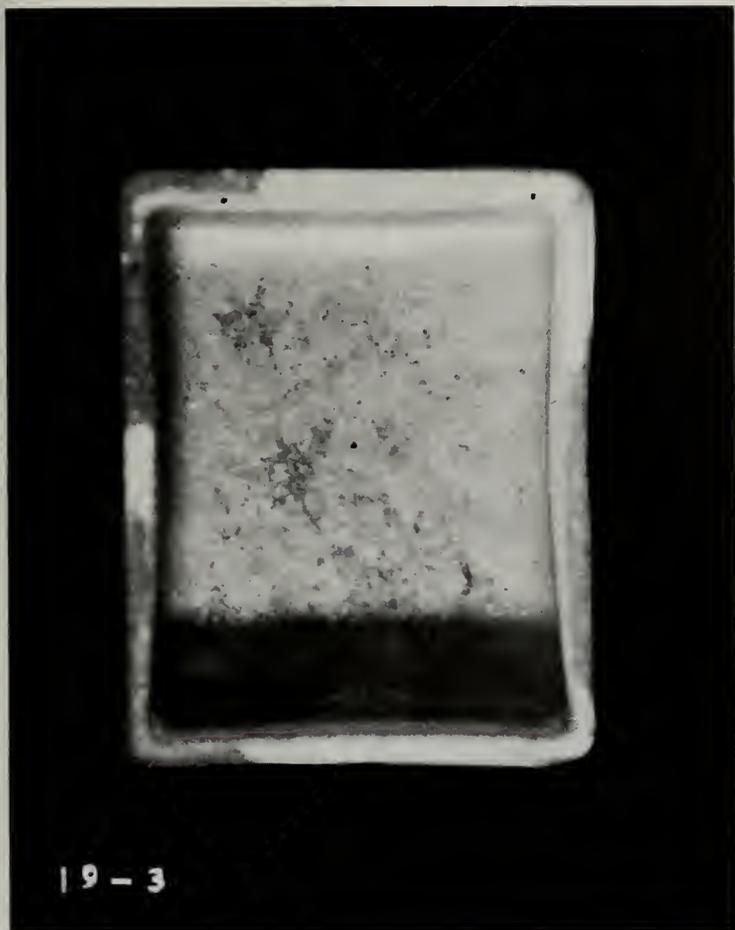


Defendant's Exhibit No. 108.

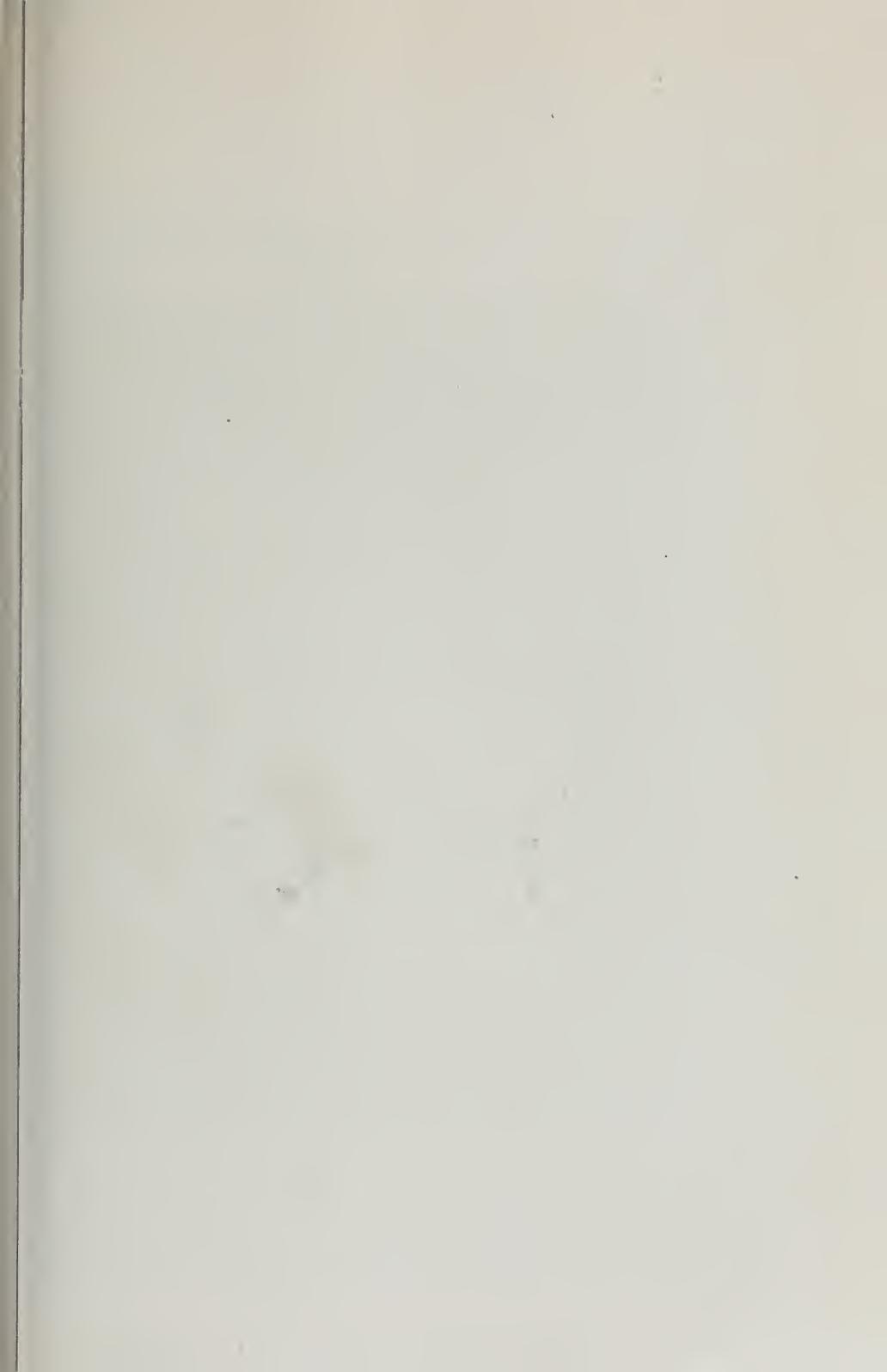


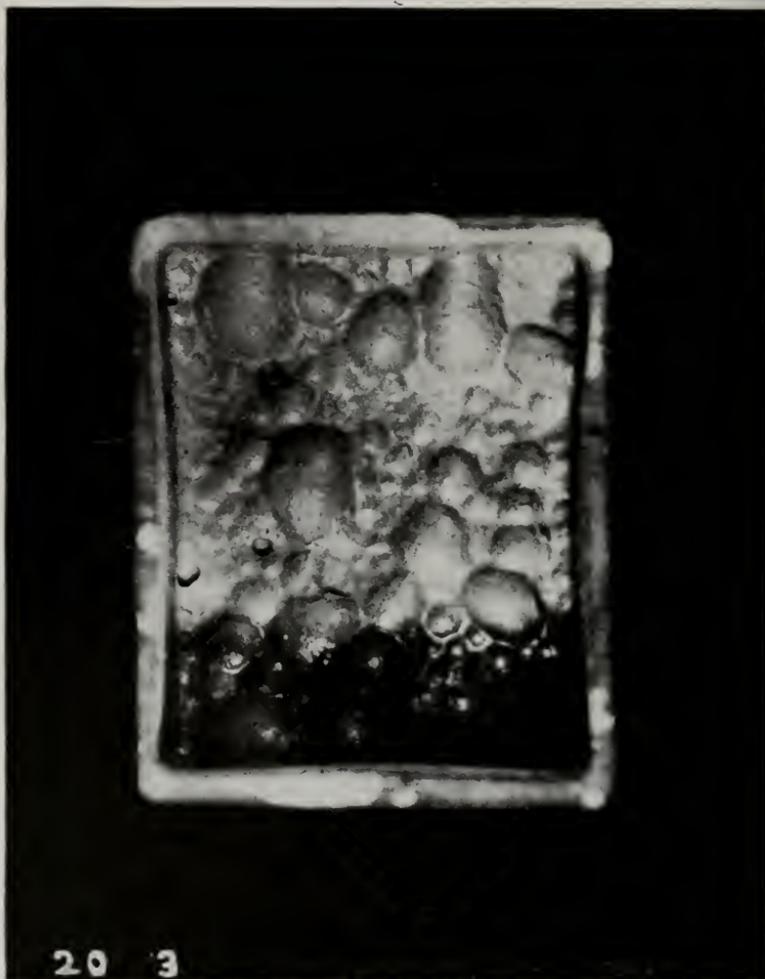
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 109.



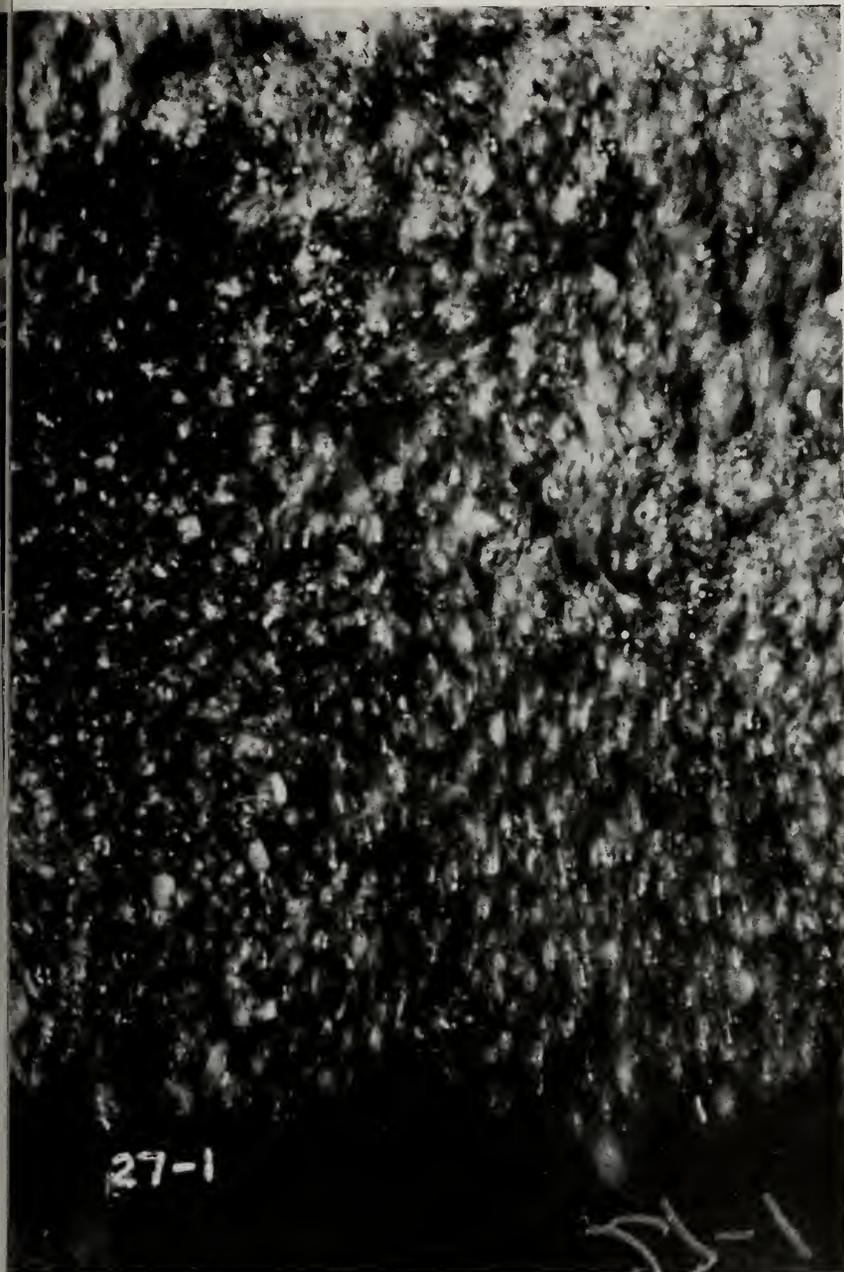
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



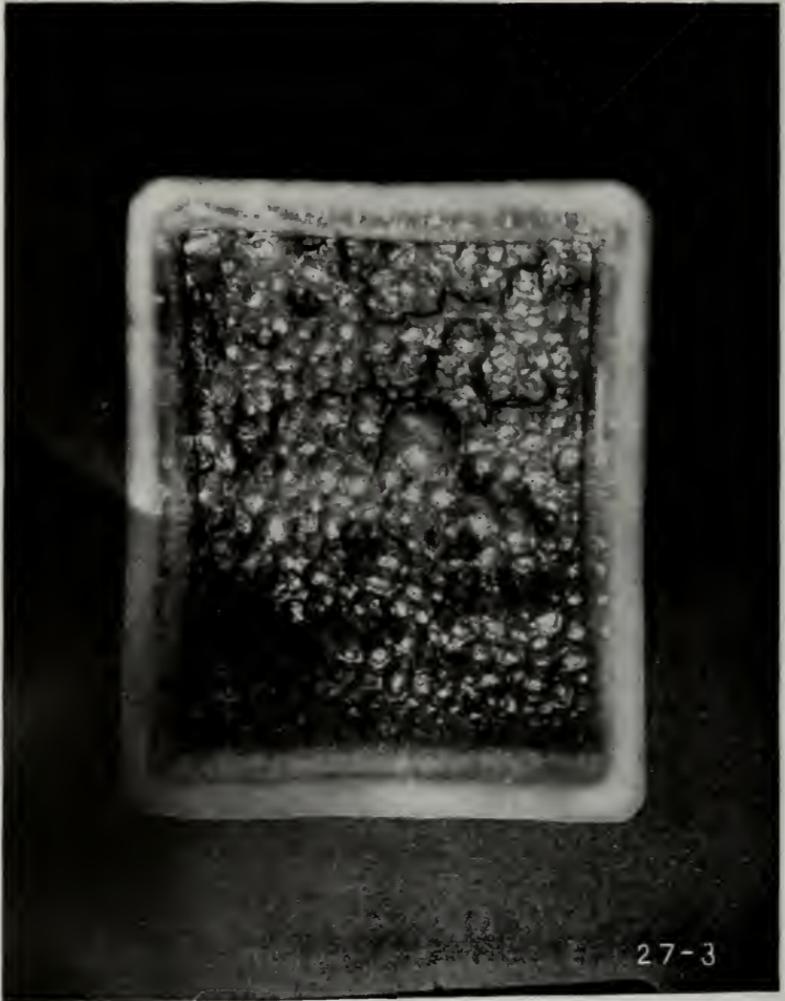
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Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 111.

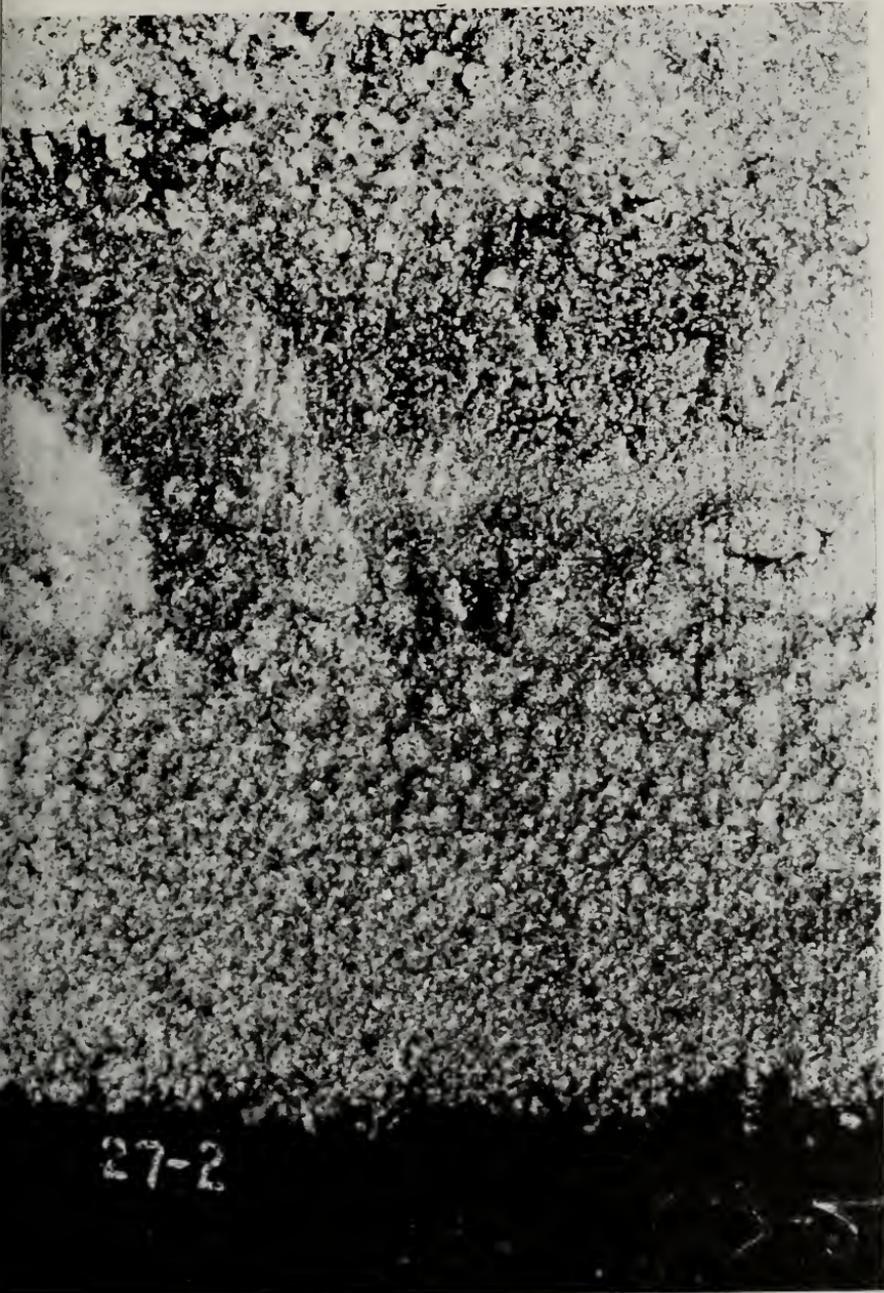


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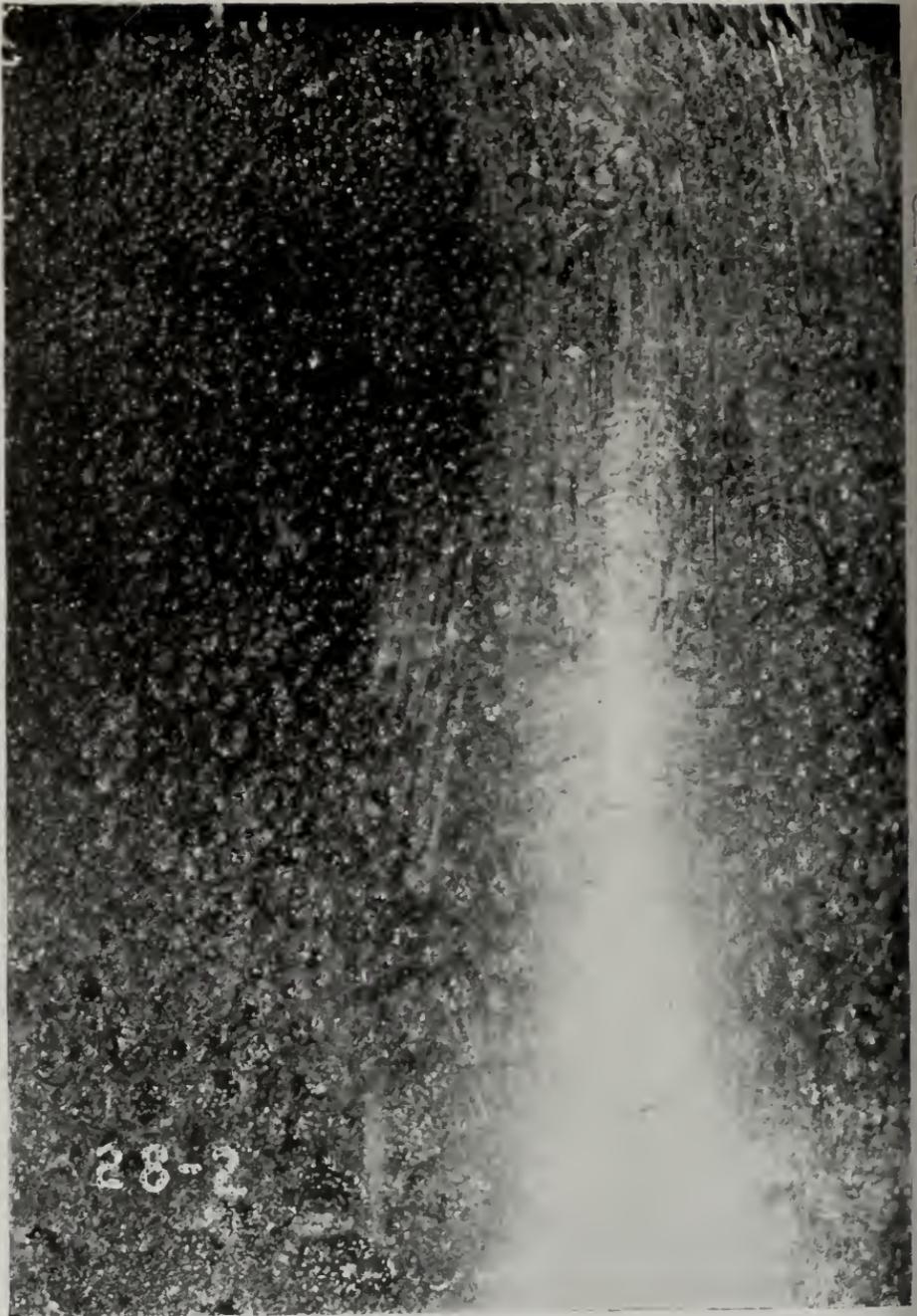
Defendant's Exhibit No. 112.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 113.

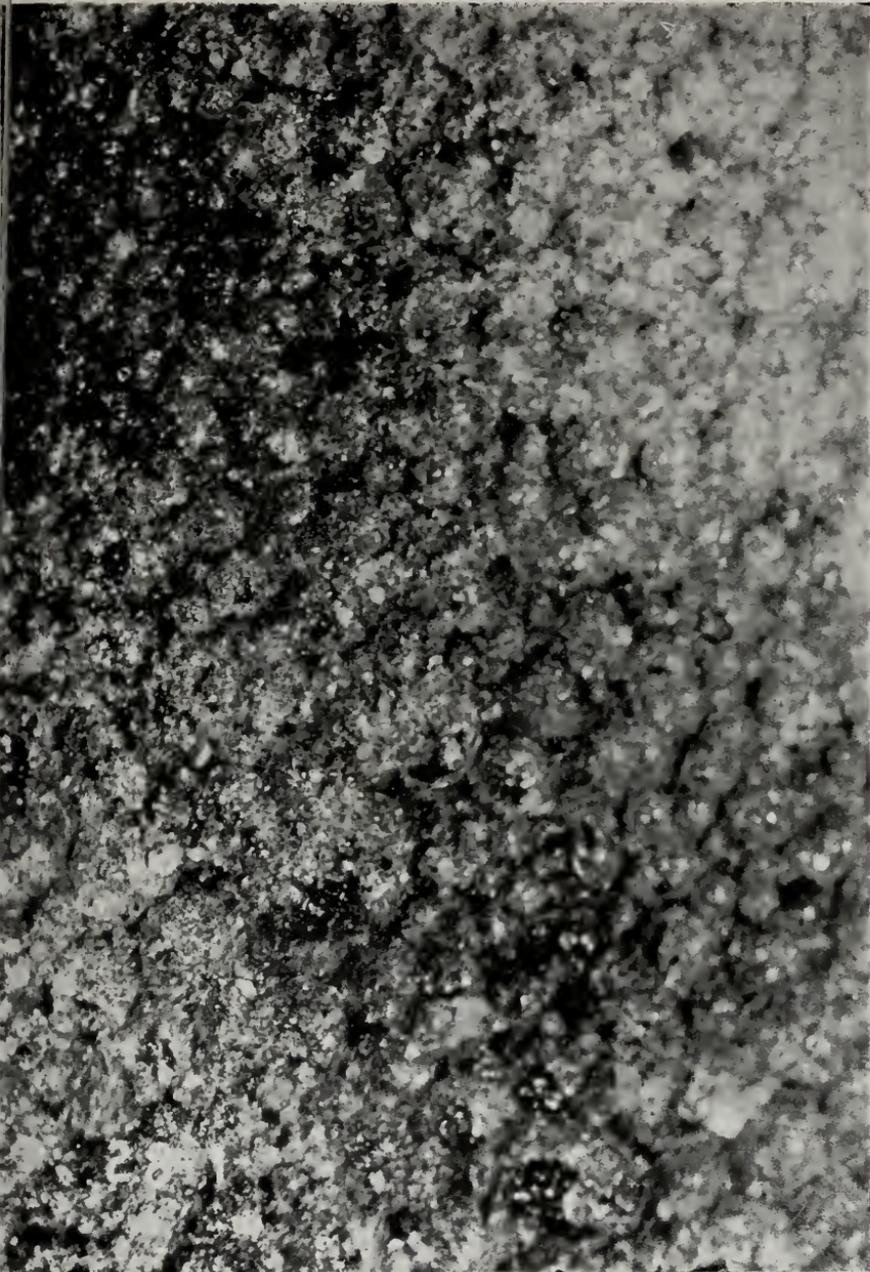


Defendant's Exhibit No. 114.



Filed May 18, 1917. GEO. W. SPROUIE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 115.



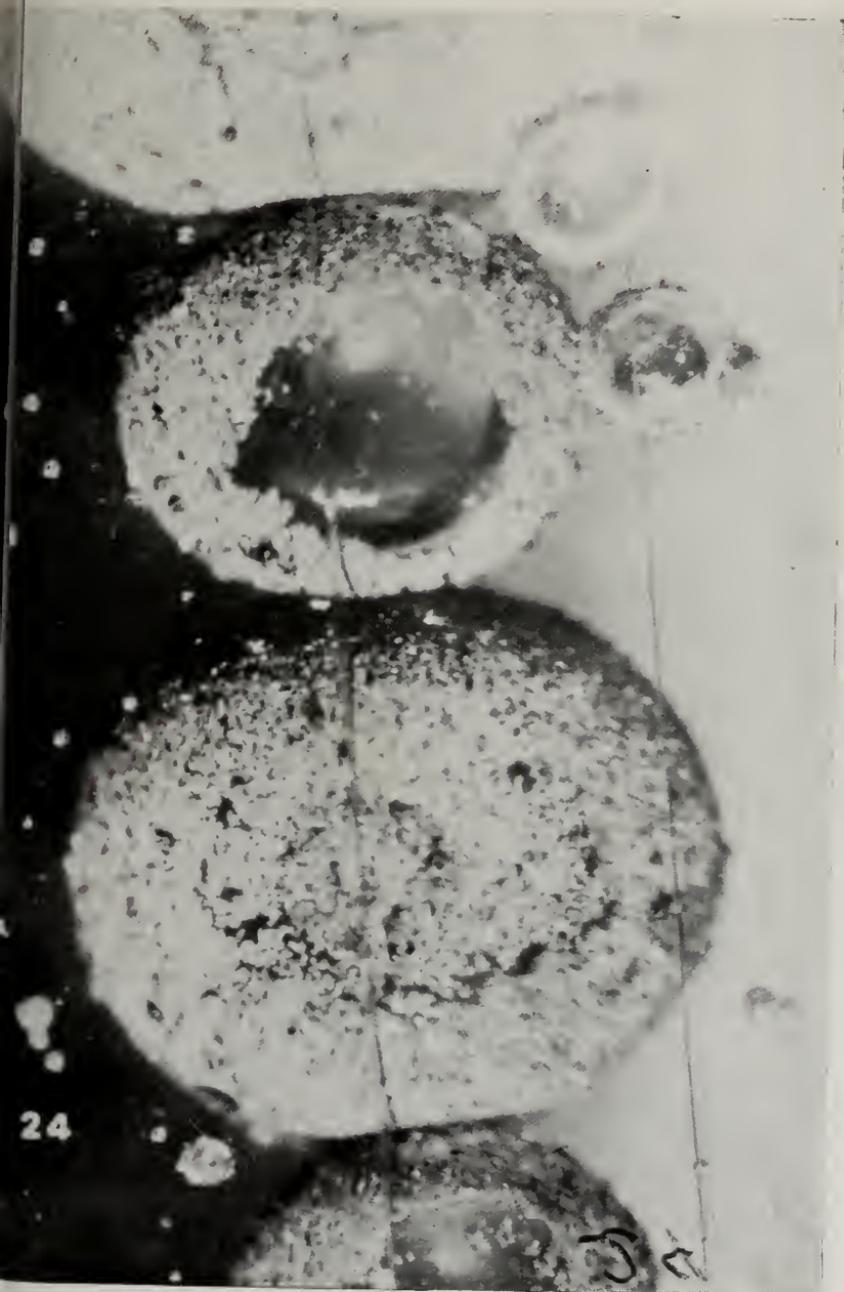
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 116.

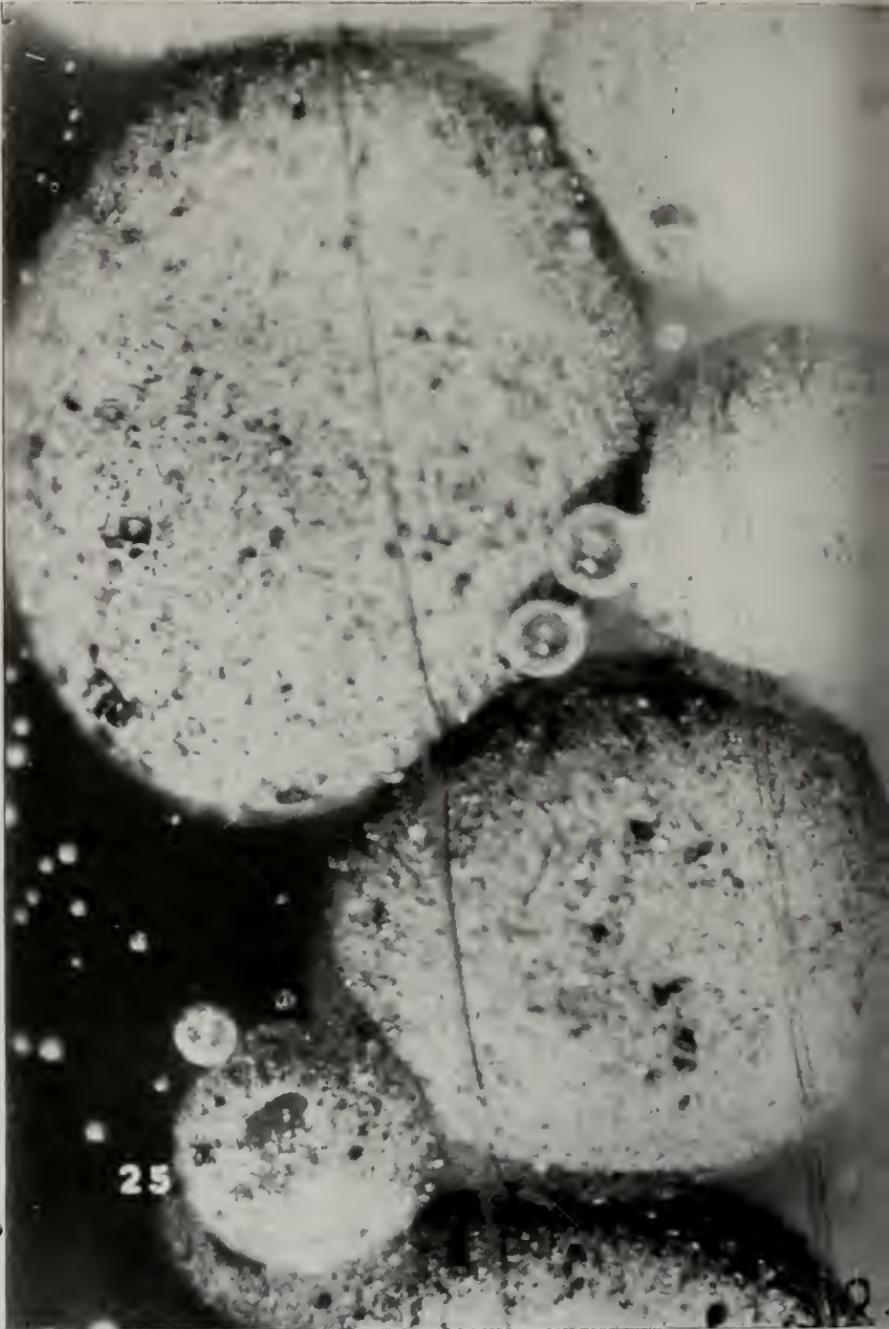


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 117.

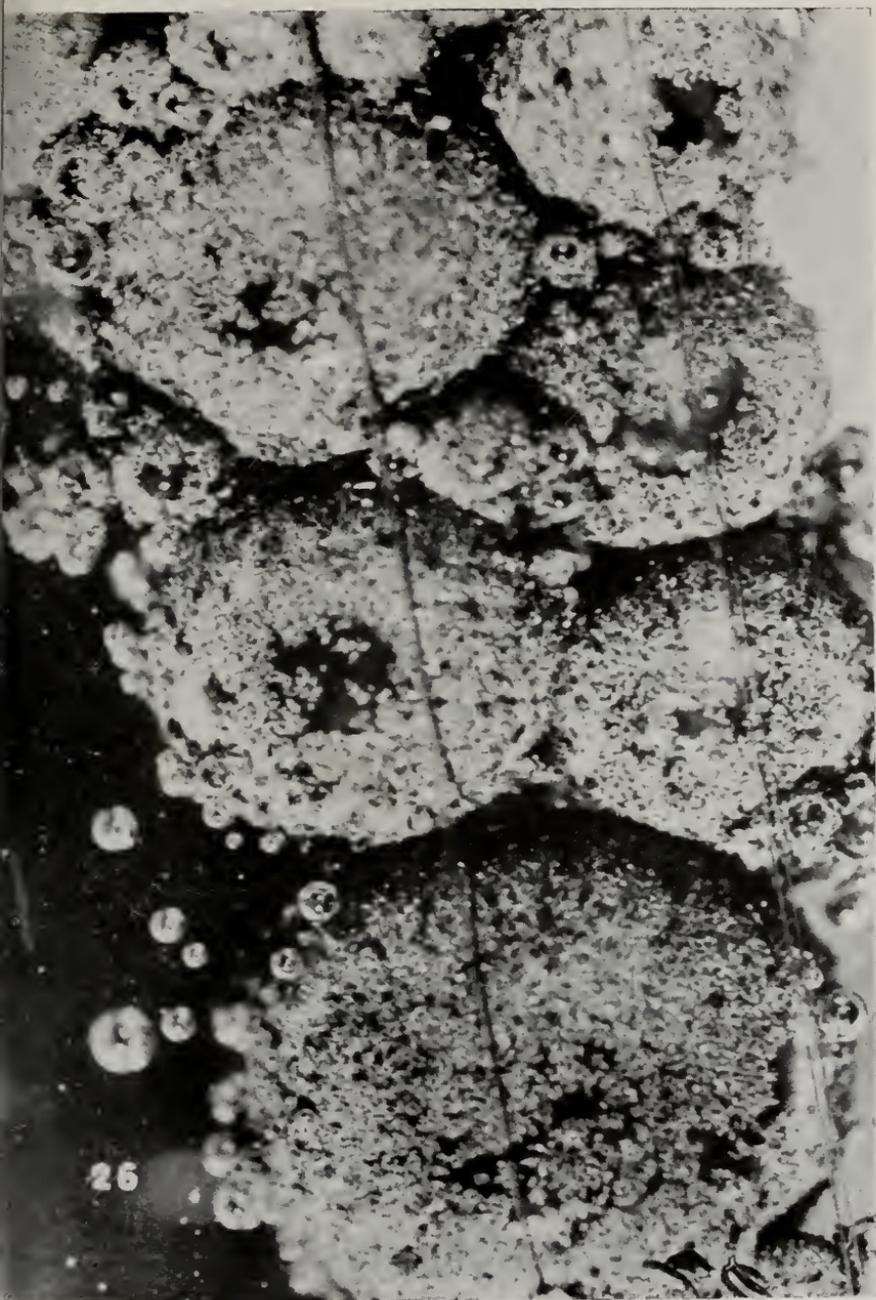


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

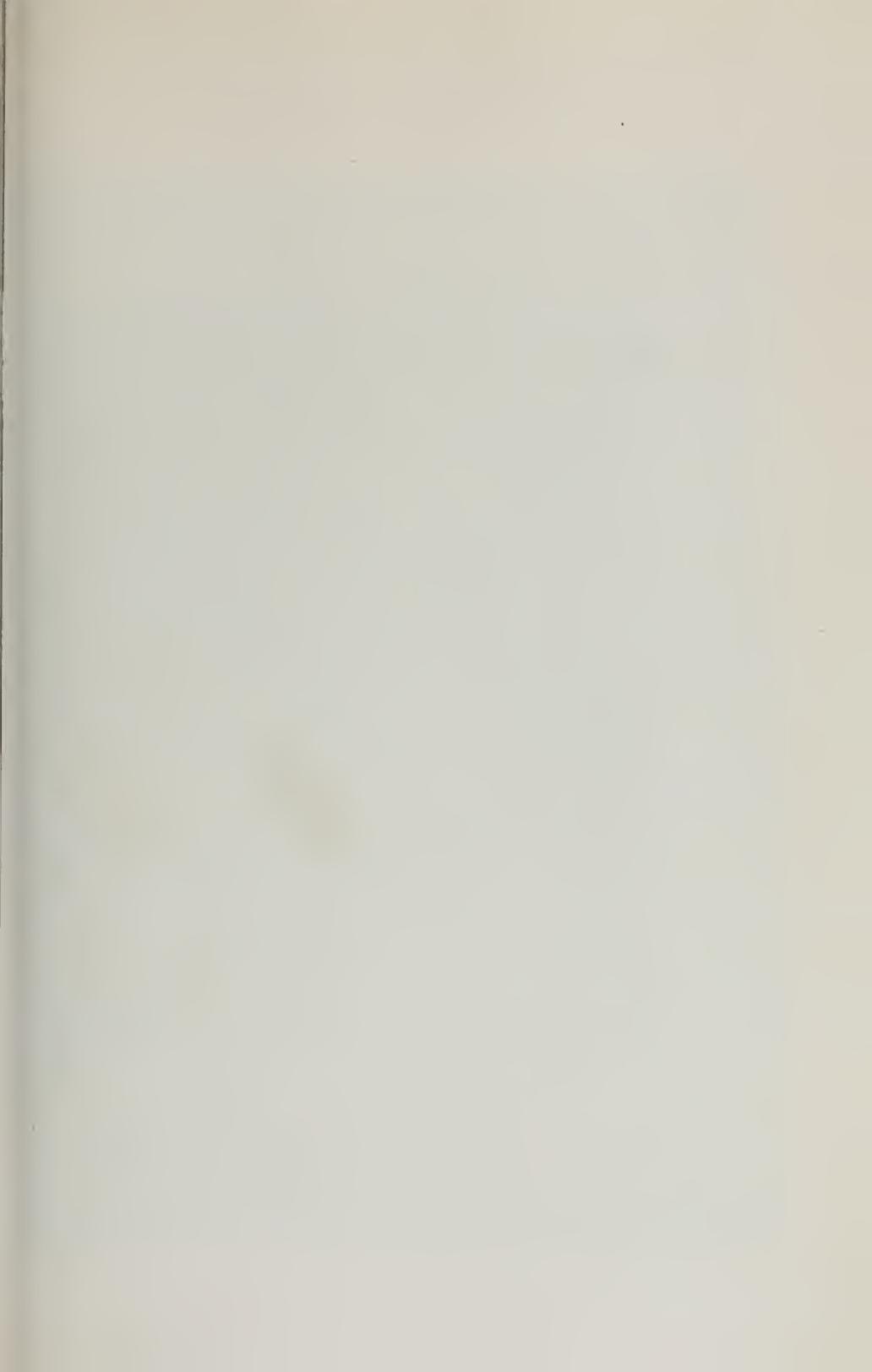
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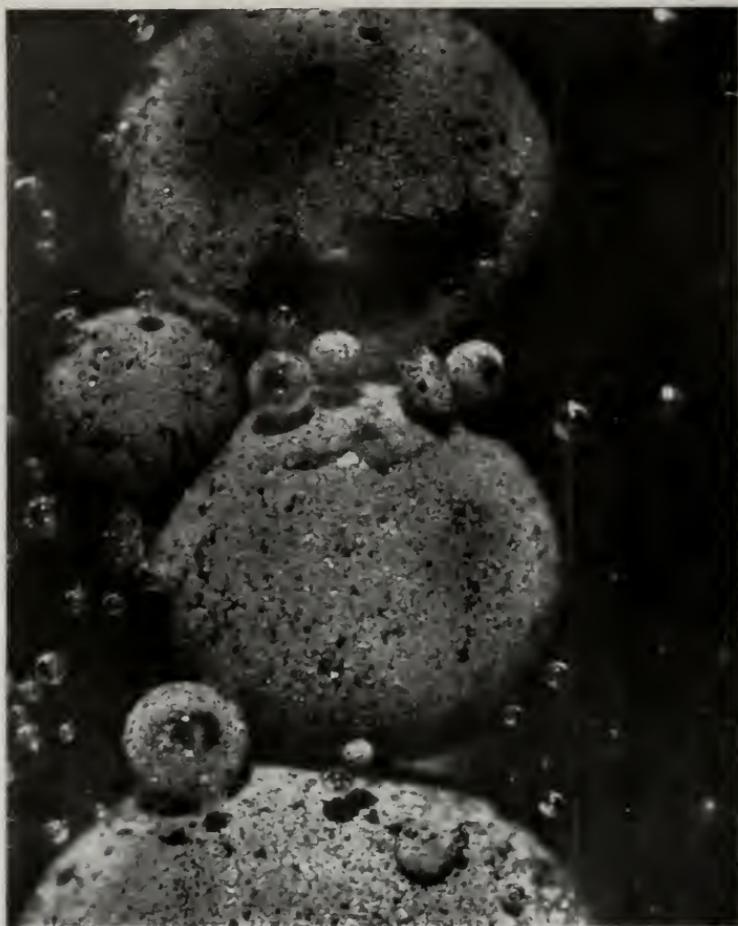
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deput

Defendant's Exhibit No. 119.



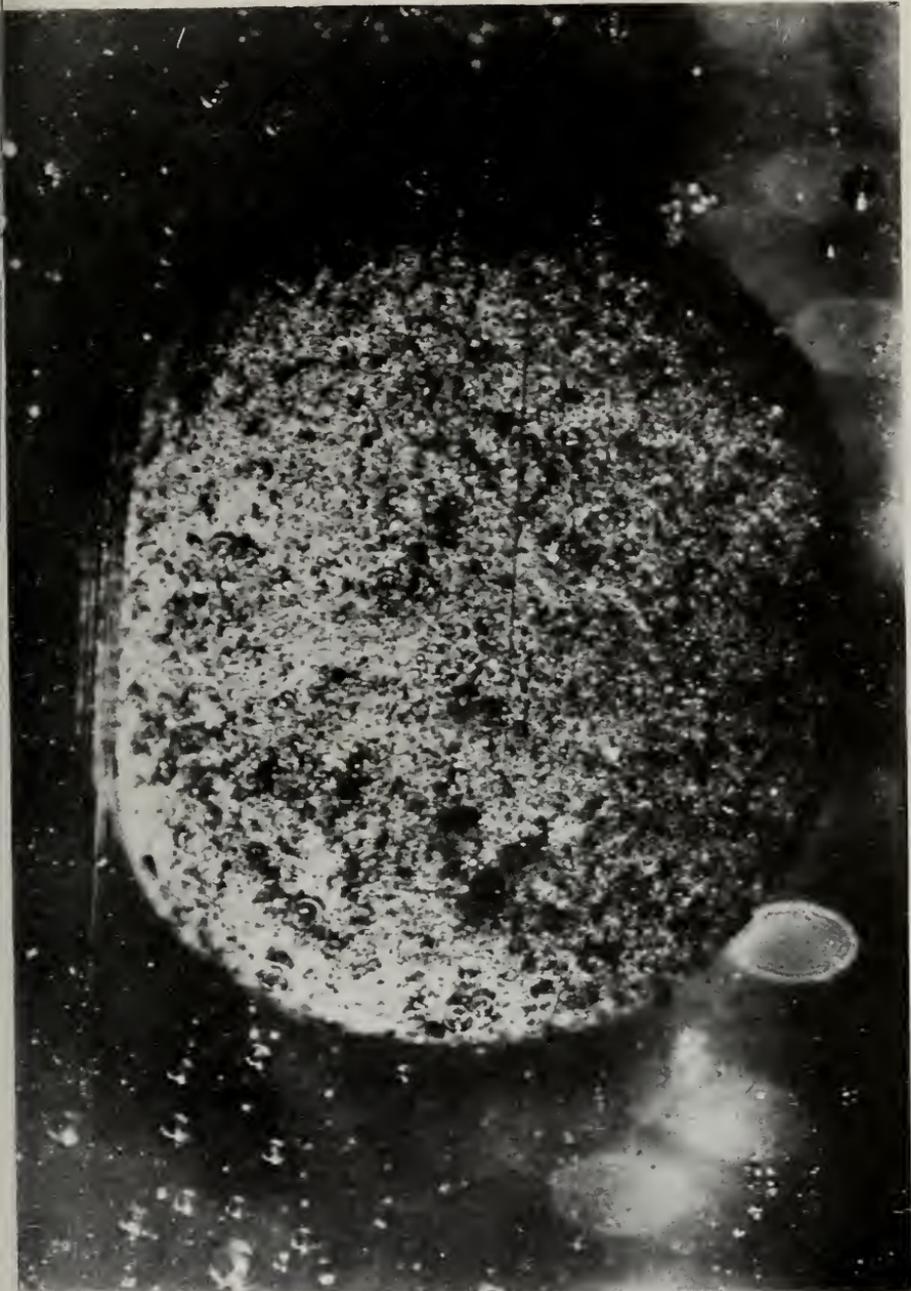
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



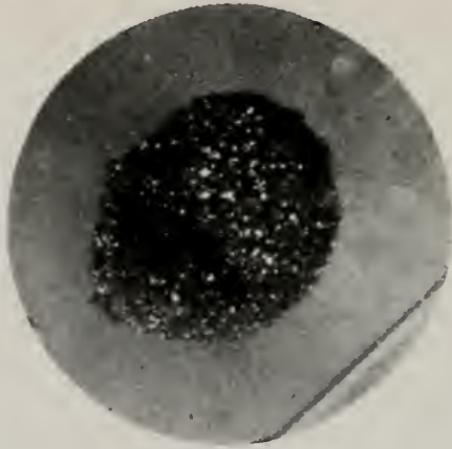
Defendant's Exhibit No. 120.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

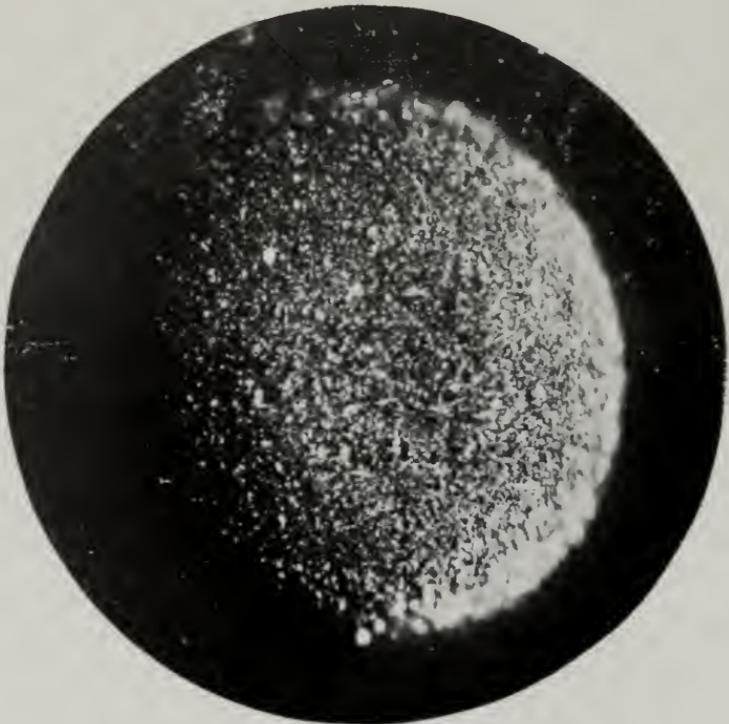
Defendant's Exhibit No. 121.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

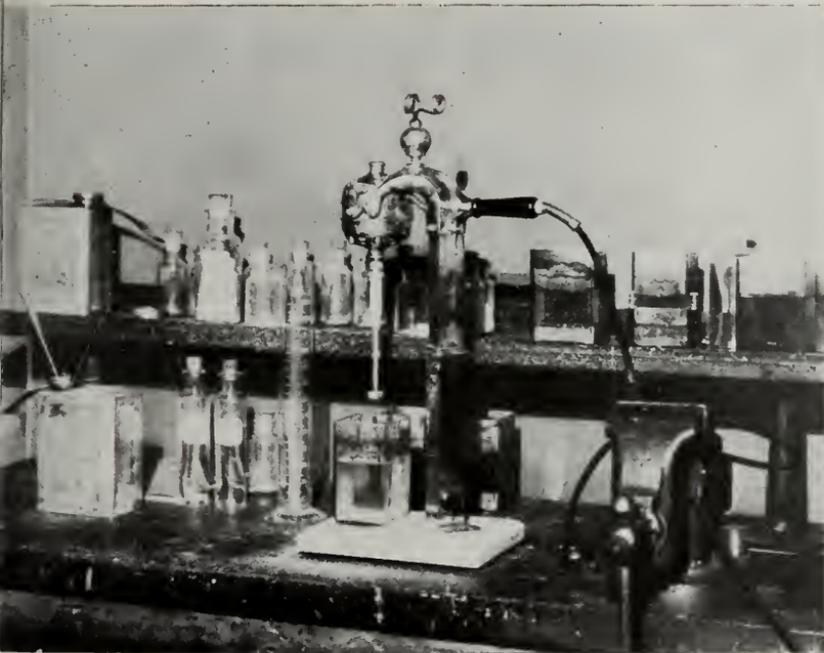
Defendant's Exhibit No. 122.

Filed May, 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 123.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 124.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

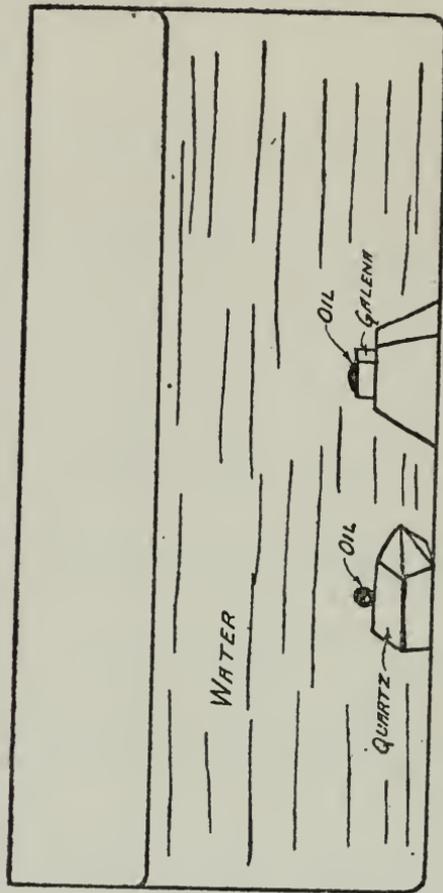
Defendant's Exhibit No. 125.

DATE	FLOTATION HEADINGS			FLOT. CONCTS. FLOTATION TAILS				Initial Oil Pounds Per Ton	Oil in Circ'g Load Lbs. Per Ton	Total Oil Pounds Per Ton	Kind of Oil Used
	Weight Dry Tons	Average Daily Tonnage	Assay Percent Copper	Weight Dry Tons	Assay Percent Copper	% Indicated Recovery	Oil Pounds Per Ton				
1915											
Apr. 16-30	8,600	573	.96	157	12.78	.74	24.33	0.85			
May 1-25	27,750	1110	.93	495	11.13	.74	21.4	1.08			
June	None										
July 13-23	8,065	733	.74	434	4.23	.54	30.73	1.45			
3rd Quar.	90,104	1251	.72	1363	16.99	.48	34.88	1.20			
4th Quar.	299,522	3256	.78	2874	23.43	.56	28.81	1.02			
Year 1915	425,976	1812	.78	4889	19.95	.56	29.32	1.06			
1916											
1st Quar.	288,320	3168	.89	2952	21.13	.68	24.25	1.04			
2d "	280,424	3081	.79	2846	26.82	.52	34.36	1.45			
3d "	328,120	3566	.82	3516	27.35	.53	35.68	1.33			
4th "	352,810	3835	.82	3676	29.64	.52	37.39	0.96			
Year 1916	1,249,674	3414	.83	12990	26.47	.56	33.05	1.19			
1917											
Jan.	127,350	4108	.75	1204	31.89	.45	40.49	1.10			
Feb.	124,900	4461	.78	1177	28.78	.51	35.23	0.53			
Mar.	136,170	4393	.71	1453	25.22	.44	37.89	1.46			
1st Quar.	388,420	4269	.74	3834	28.47	.47	37.84	1.04			
Aver. of all Oper. to Date	2,064,070	3127	.804	21713	25.352	.543	33.139	1.13			
Jan. 7	2,058		.98	19.	22.47	.78	24.07	9.72	*2.43	12.15	Jones
Mar. 13	205		.67	3.3	9.10	.53	25.50	24.19			Stove
Mar. 14	122		.80	1.4	27.60	.48	41.00	22.80			Coal Tar
Mar. 21	135		.69	1.4	25.10	.44	37.00	37.79			Stove
Mar. 27	2,300		.63	44.7	11.73	.41	36.20	32.27			Taft
Apr. 2	1,700		.61	21.0	14.87	.43	30.40	10.54			Sulphur
Apr. 2	1,965		.65	23.2	14.87	.48	27.00	.34			Gashouse
Apr. 4	3,250		.57	21.8	25.73	.40	30.30	8.10	3.2	11.3	tar
											"

* Approximate quantity.
(Signed) O. WISER,
Metallurgical Engineer.

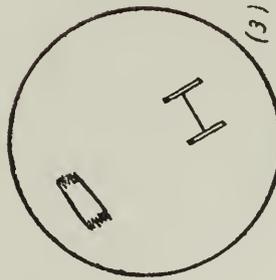
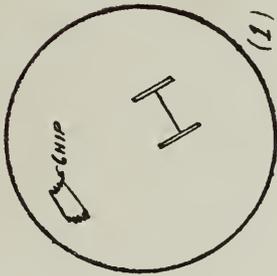
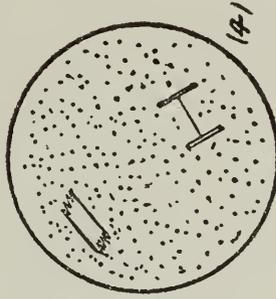
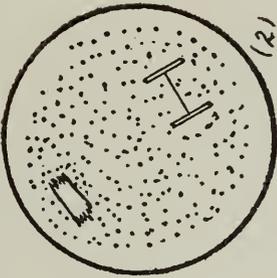
Recompiled at Butte.
April 19, 1917.

DIAGRAM No. 3 — DEF. EXIB. No. 126 - A.F.T.



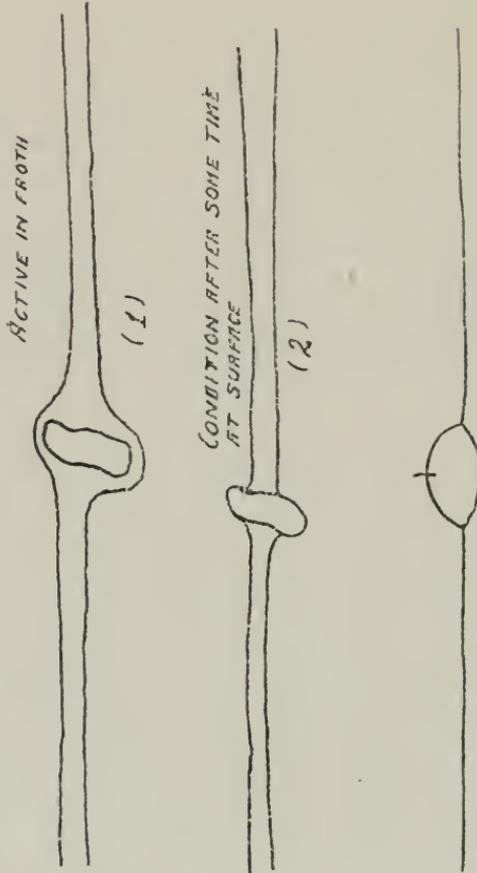
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 4. — DEF. EXIB. NO. 127 - A.F.T.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

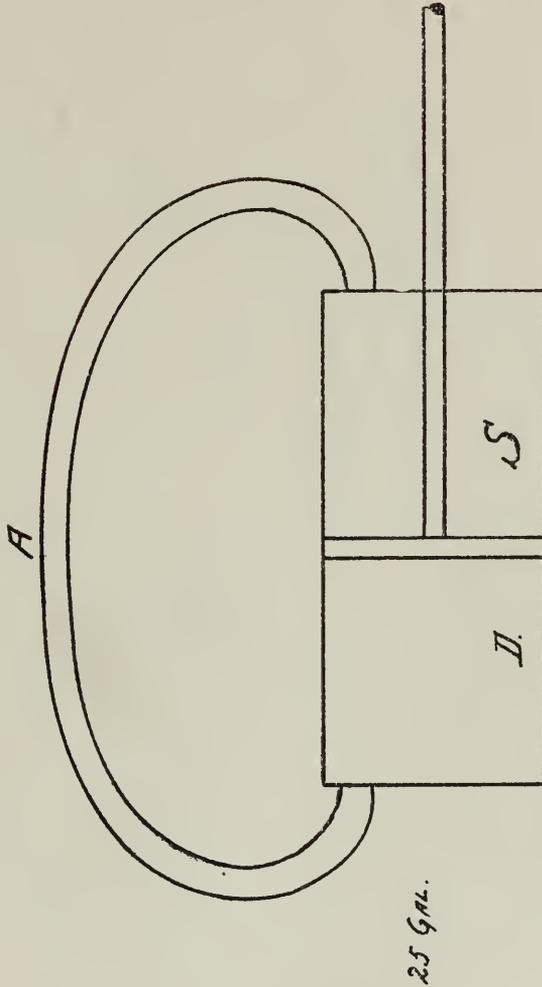
DIAGRAM No. 5. — DEF. EXIB. No. 128 — A. F. T.



Filed May 18, 1917.

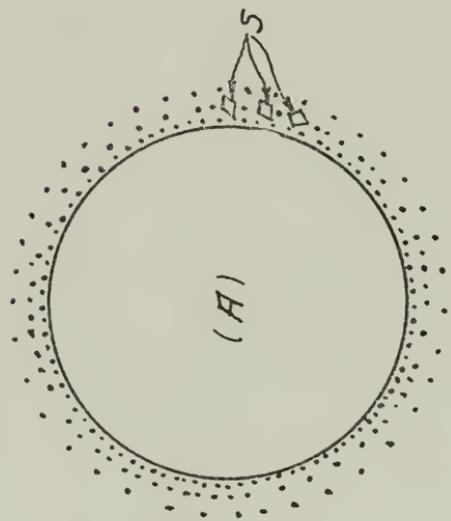
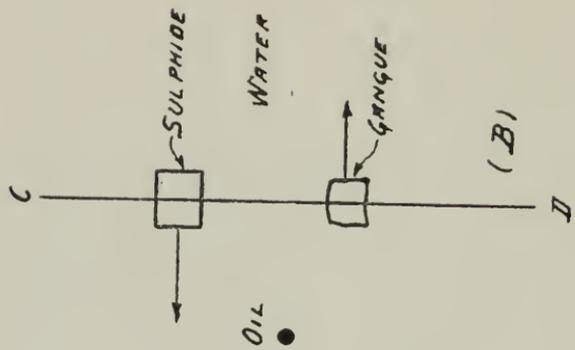
GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 6. — DEF. EXIB. NO. 129 — A.F.T.



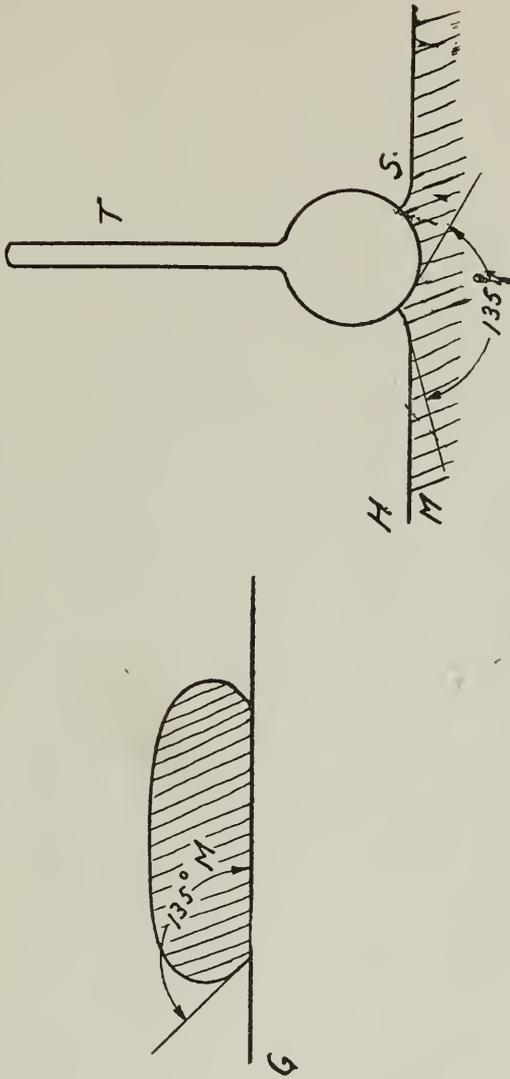
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 7. — DEF. EXIB. NO. 130. — R. F. T.



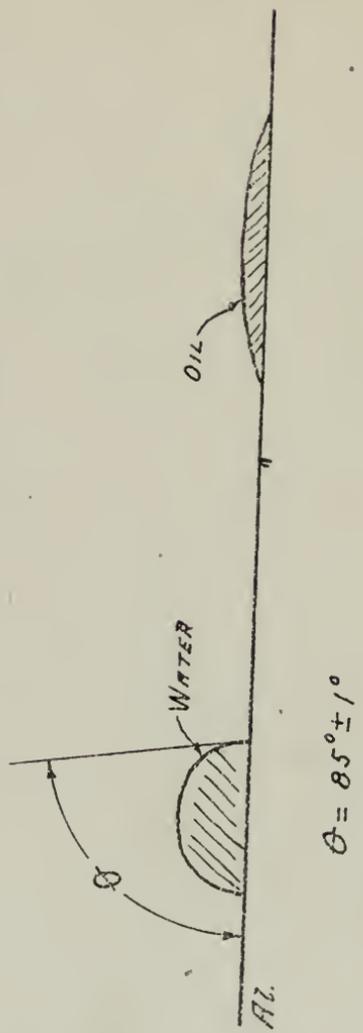
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 8. — DEF EXIB. No. 131 — F.E.B.



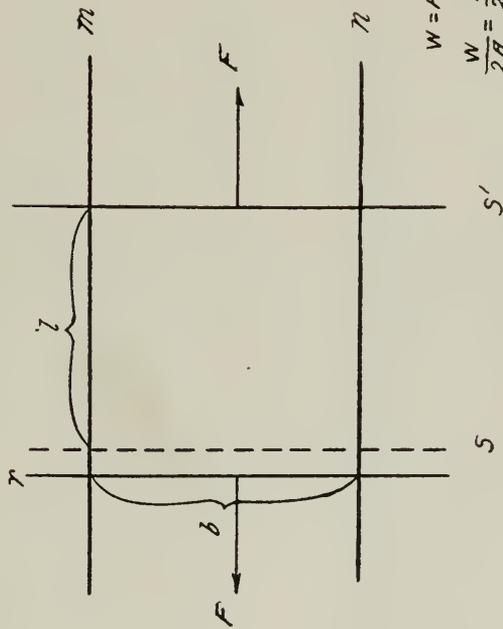
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 9 — DEF. EXIB. No. 132 — F.E.B.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 10. — DEF. EXIB. NO. 133 — F. E. B.



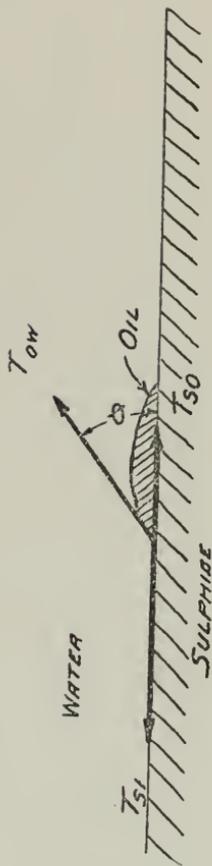
$$W = Fz$$

$$\frac{W}{2A} = \frac{Fz}{2b} = T$$

$$T = 27 \frac{\text{Dynes}}{\text{cm}} = 27 \frac{\text{Ergs}}{\text{cm}^2}$$

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 11. — DEF. EXIB. No. 13f — F.E.B.



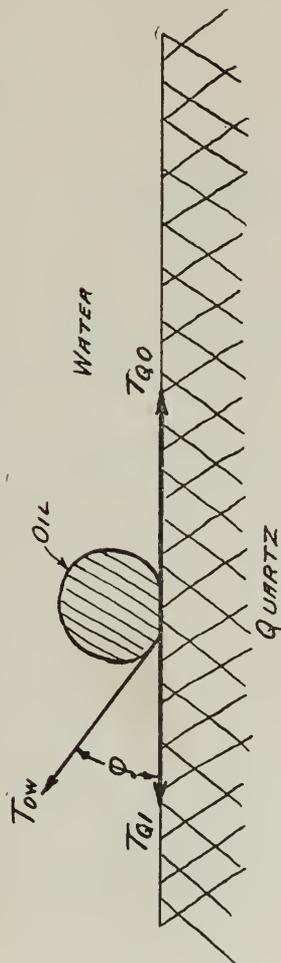
$$T_{SI} = T_{SO} + T_{OW} \cos. \theta$$

$$T_{SI} > T_{SO}$$

A_{SI} TENDS TO DIMINISH WITH RESPECT TO A_{SO}

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 12. — DEF. EXIB. NO. 135 — F. E. B.



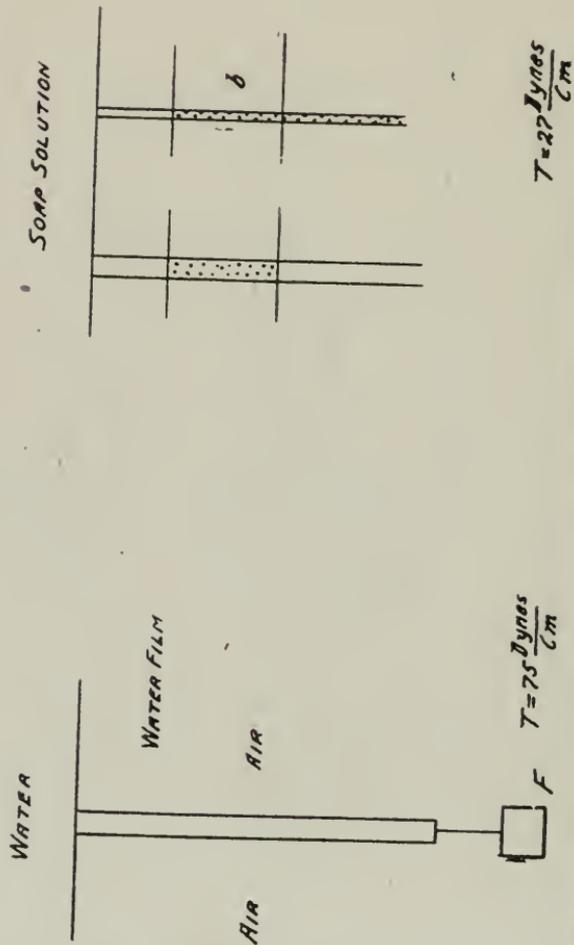
$$T_{Q0} = T_{Q1} + T_{OW} \cos \phi$$

$$T_{Q0} > T_{Q1}$$

A_{Q0} DIMINISHES WITH RESPECT TO A_{Q1}

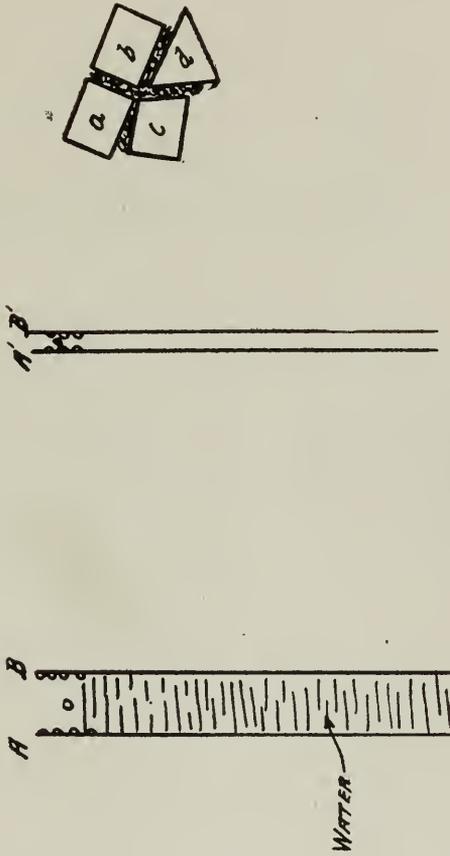
Filed May 18, 1907. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Diagram No. 13. — DEF. EXIB. No. 136 — F. E. D.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 17. — DEF. EXIB. No. 137 — F.E.B.

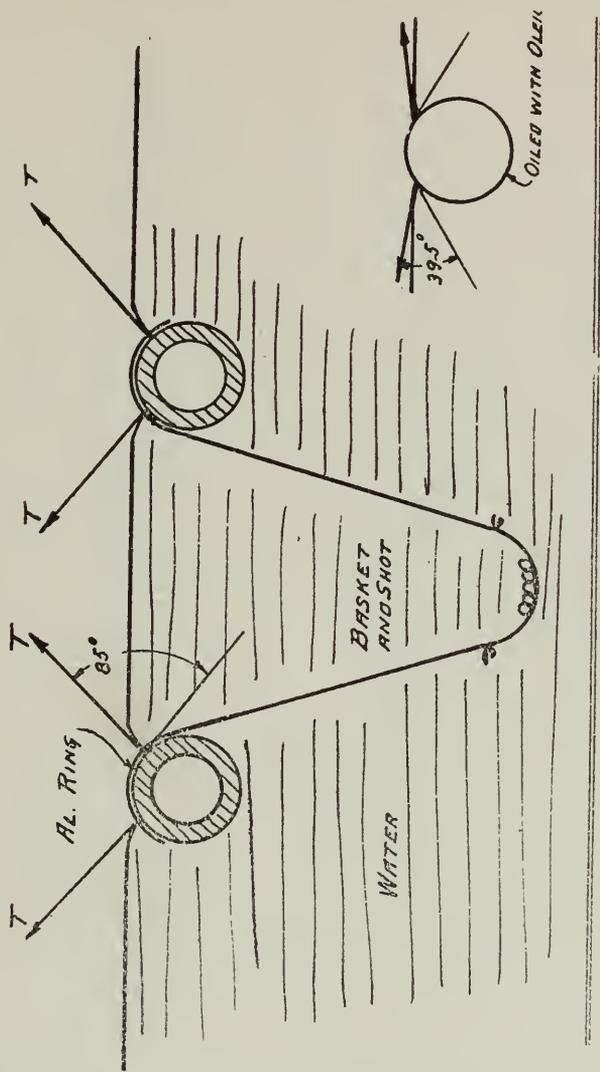


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 138.

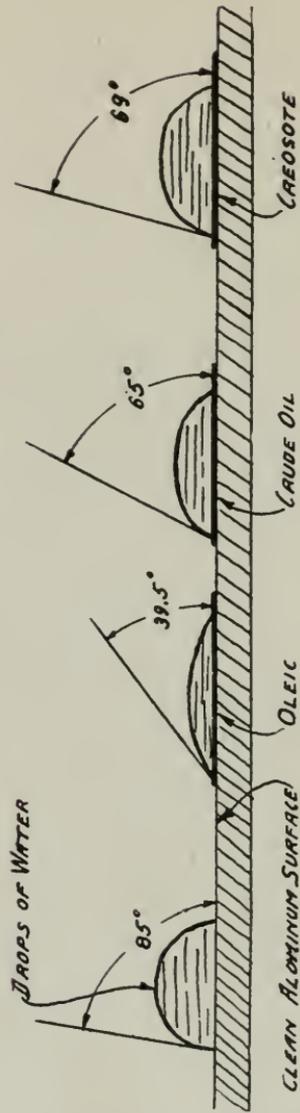
(Used by Mr. Williams to identify Prof. Taggart's article. This exhibit was identified but not admitted in evidence.)

Diagram No. 15. — *Page* EXHIB. No. 139 — F.E.B.



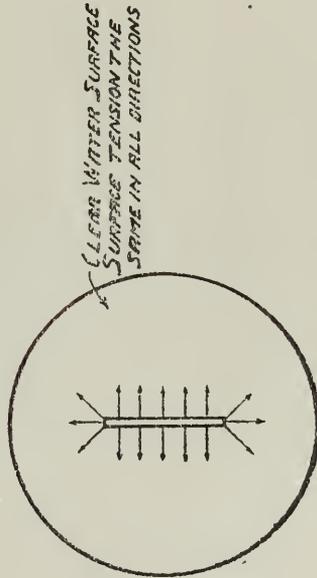
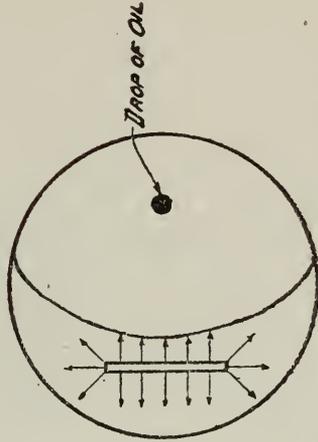
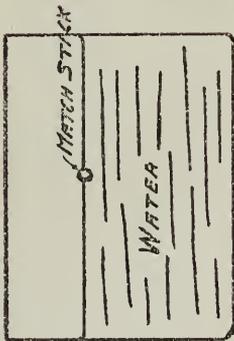
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 16. — ^{Plat} JEFF. EXIB. NO. 170. — F. E. B.



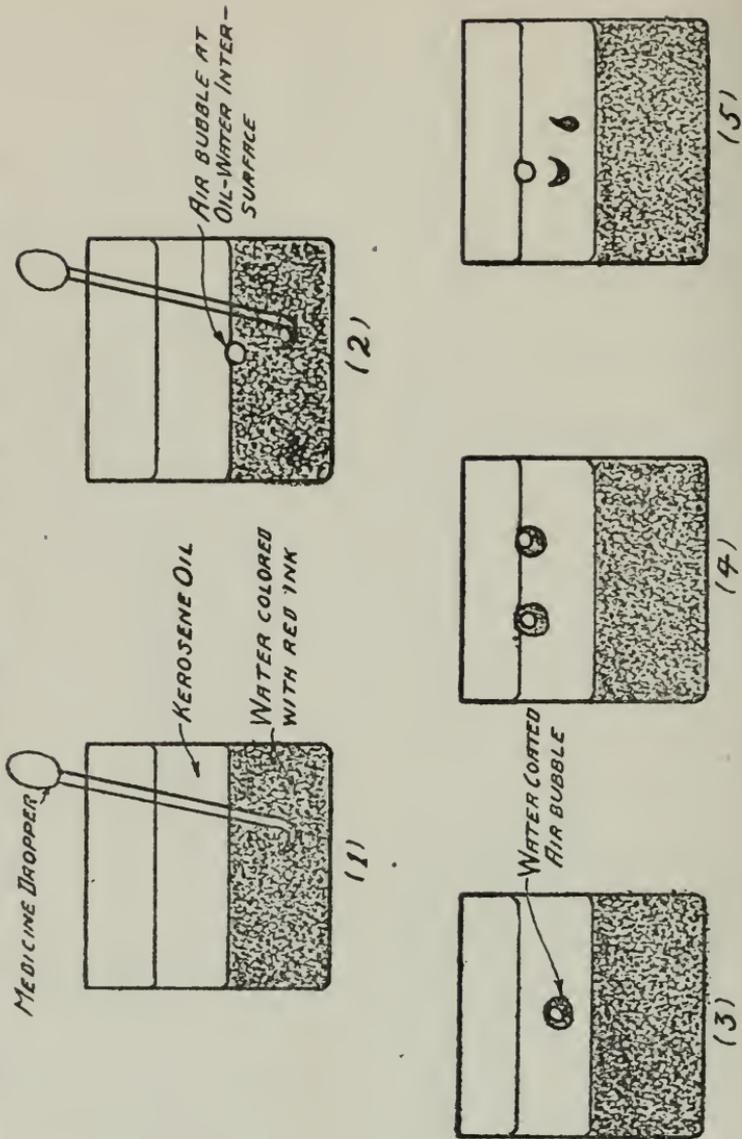
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 1. — DEF. EXIB. NO. 191. — A.F.T.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 2. — DEF. EXIB. NO. 192 — A.F.T.



Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 143.

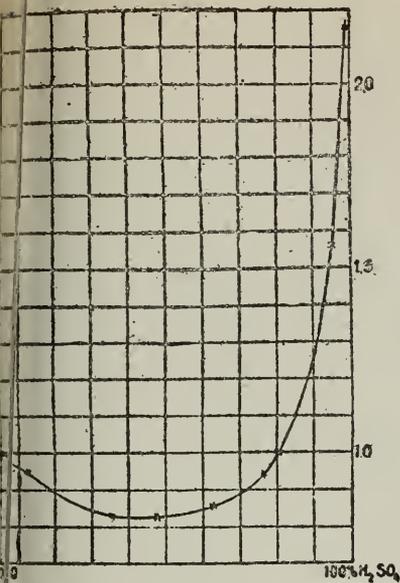


Fig. 14a.

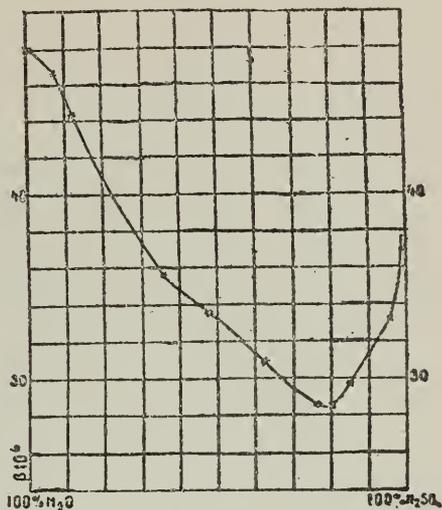


Fig. 14b.

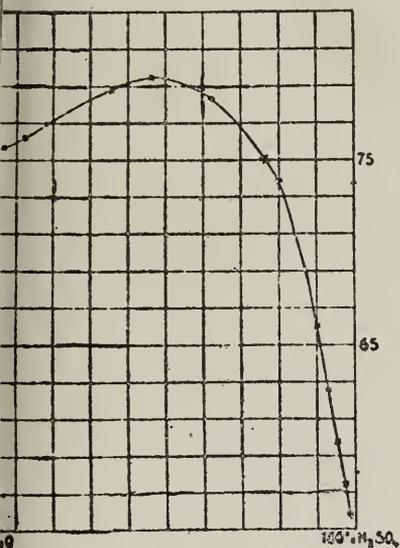


Fig. 14c.

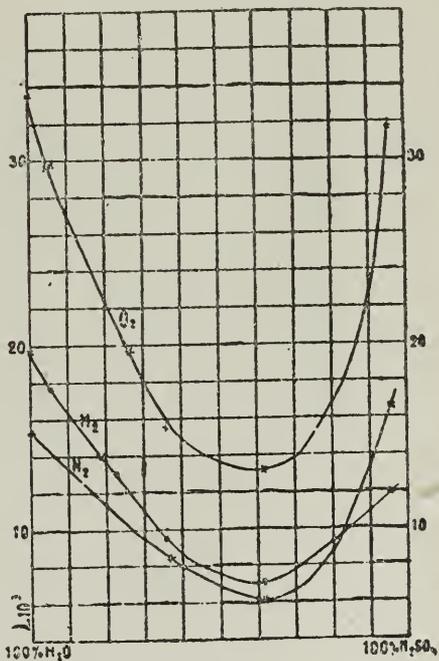
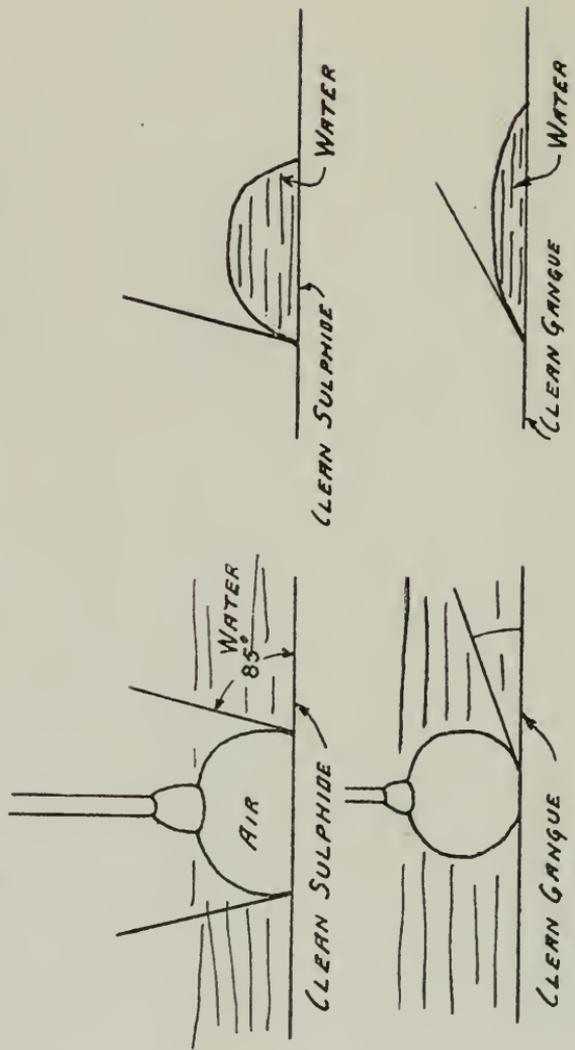


Fig. 14d.

Filed Sept. 11, 1917.

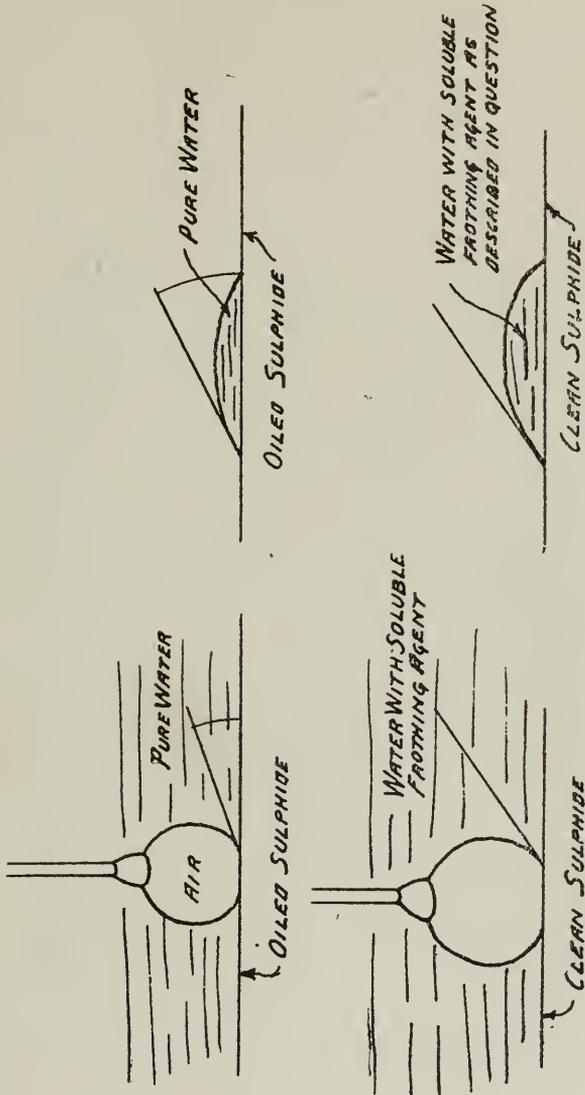
GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 12. — DEF. EXIB. NO. 177. — F. E. B.



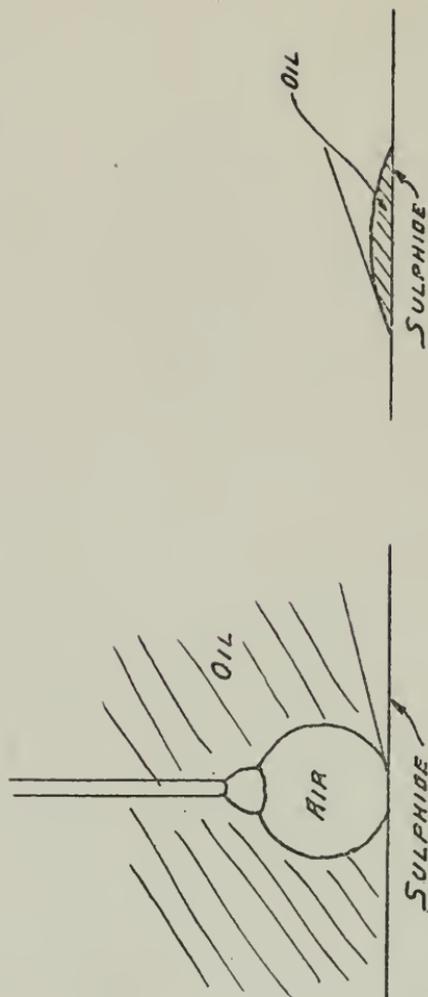
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 18. — DEF. EXIB. No. 195. — F.E.B.



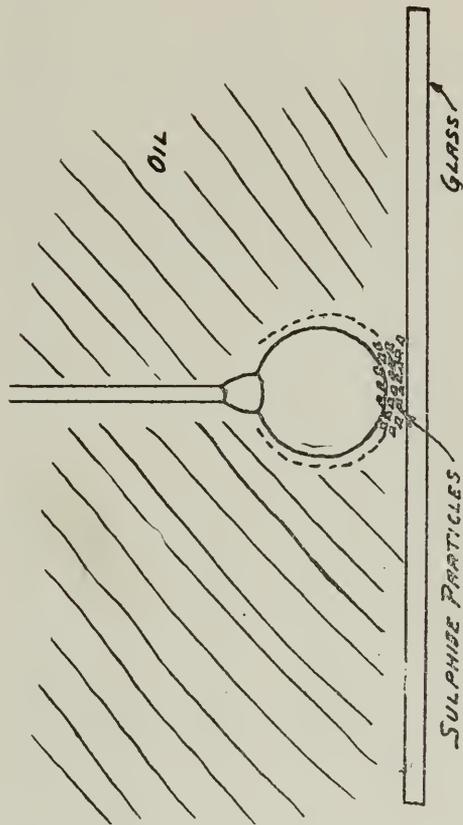
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 19. — DEF. EXIB. No. 146 — F.E.B.



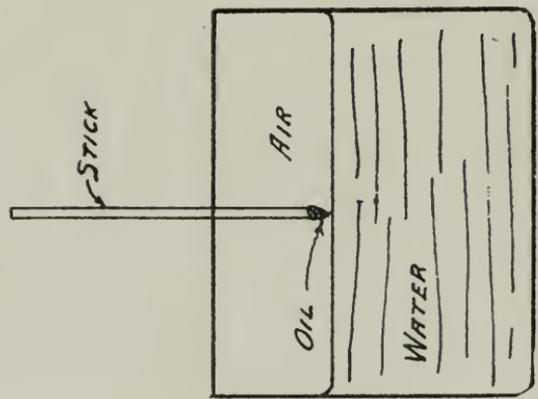
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 20. — DEF. EXIB. No. 147. — F. E. B.

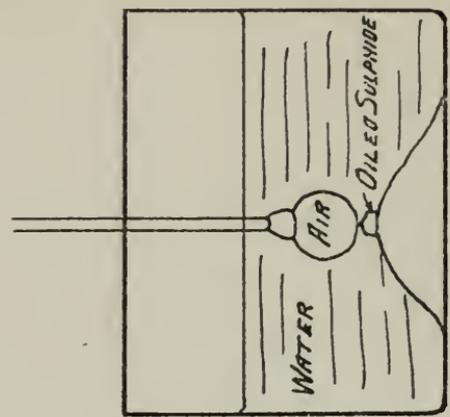


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No. 21 — DEF. EXIB. No. 148 — F. E. B.



V

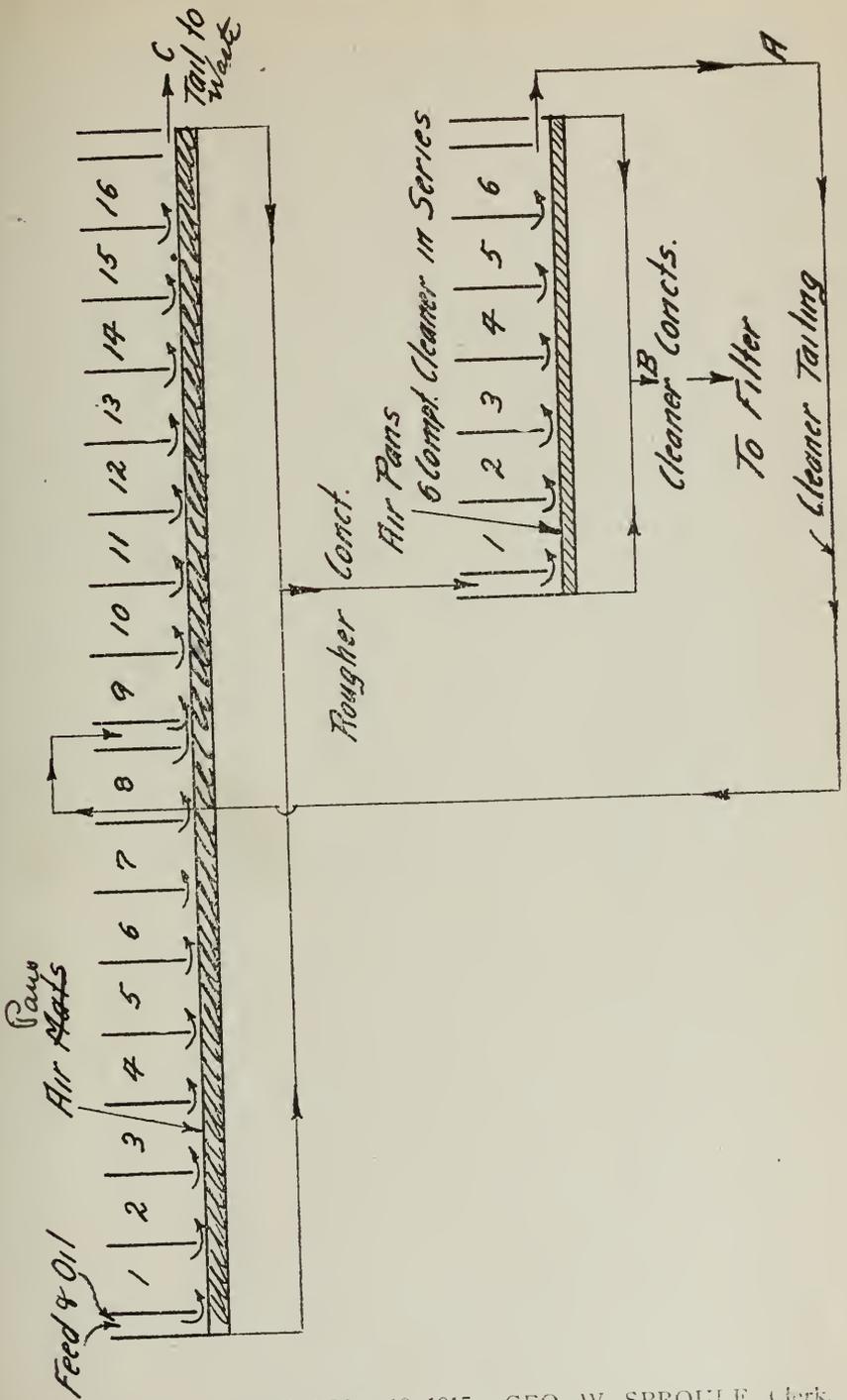


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Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 149.

Air Machine - Treating Slime Vanner Tailing



Defendant's Exhibit No. 150.

RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT
FLOTATION OPERATIONS
Retreating Vanner Concentrate Products

PERIOD	FLOT. HEADS		FLOT. CONCTS.		TAILS		FLOTATION		NEW OILS		OIL ASSAYS PERCENT	
	Tons	Assay % Cu.	Tons	Assay % Cu.	Assay % Cu.	Assay % Cu.	Copper Appr. %	Recovery Estm. %	Lbs. Per Ton	Flotation Heads Including Circul. Load	Concts.	Tails
1914												
4th Quarter	8821	6.87	1892	29.78	.617	92.94	92.94	4.31				
1915												
1st Quarter	17849	6.42	3752	28.94	.425	94.76	94.76	3.47				
2d "	8802	5.60	1702	27.33	.397	94.28	94.28	5.28				
3d "	17328	5.73	3797	24.17	.554	92.45	92.45	4.92				
4th "	19558	6.12	4200	26.44	.574	92.64	92.63	4.42				
YEAR	63537	6.029	13451	26.61	.502	93.439	93.436	4.41				
1916												
1st Quarter	20190	4.967	3629	25.37	.496	91.80	91.80	3.34				
2d "	22750	5.460	4362	26.62	.441	93.47	93.47	3.23				
3d "	22750	5.840	4767	26.59	.316	95.73	95.73	3.22				
4th "	27275	6.099	6086	26.38	.273	96.52	96.52	3.54				
YEAR	92965	5.630	18864	26.30	.375	94.69	94.69	3.36				
1917												
January	9300	6.24	2267	23.99	.456	94.48	94.48	20.02				
February	8550	6.63	2289	23.63	.422	95.33	95.33	18.77	1.07	2.87	.10	
March	11063	6.70	3377	21.07	.368	96.19	96.19	21.19	.97	3.15	.033	
1st Quar. Average	28913	6.531	7983	22.76	.412	95.42	95.42	20.10	1.01	3.03	.062	

(Signed) E. W. ENGLEMANN,
Flotation Foreman.

Hayden 3/29/1917
Copied Bufile, Apr. 23, 1917.

Defendant's Exhibit No. 151.

HAYDEN PLANT

FLOTATION OPERATIONS

Treating Slime Vanner Heading & Slime Vanner Tailing

PERIOD	FLOT. HEADS		FLOT. CONCTS.		TAILS		FLOTATION		OILS		OIL ASSAYS PERCENTS		
	Tons	Assay % Cu.	Tons	Assay % Cu.	Assay % Cu.	Copper Appr. %	Recovery Estm. %	Lbs. Per Ton	Flotation Heads Including Circul. Load	Concts.	Tails		
1915													
2d Quarter	33,721	1.170	1,045	20.84	.516	57.54	57.32	1.94					
3d " "	95,051	1.122	3,464	11.406	.733	37.04	37.04	1.96					
4th " "	163,144	.730	2,061	19.42	.493	33.40	33.31	1.52					
YEAR	291,916	.908	6,570	15.42	.572	38.20	37.67	1.71					
1916													
1st Quarter	205,621	.833	3,259	21.96	.498	40.80	40.80	1.40					
2d " "	410,213	.748	5,162	26.45	.422	44.49	44.49	.84					
3d " "	452,574	.752	6,632	25.28	.387	49.23	49.02	.76					
4th " "	557,764	.755	7,888	24.41	.416	45.73	45.67	.72					
YEAR	1,627,172	.762	22,921	24.71	.419	45.64	45.64	.85					
1917													
Jan. 17 & 18	1,803	.813	24	27.31	.465	43.56	43.55	20.30					
Feb. 8 to 28	7,597	.668	188	12.22	.375	45.25	45.25	20.10	1.029			3.65	
Mar. 1st to 14th, Inclusive	4,549	.653	104	10.25	.439	34.31	34.24	20.54					
Mar. 15th to 17th, Inclusive	2,000	.725	69	7.60	.568	24.36	23.40	24.31					
Mar. 20th to 26th, Inclusive	6,660	.731	521	17.97	.606	17.74	17.69	21.34					

NOTE:

Results from Feb. 8th to Mar. 14th were obtained when using coal tar oil mixtures on Air Machine. The construction of this machine is such that only one cleaning can be obtained. This corresponding product, on our large installation receives a double, or two recleanings, thus raising the grade of concentrate to 25.00% Cu. Our corresponding primary concentrate when using less than 1 pound of oil per ton material treated will average 12.00% Cu. The results on January 17th and 18th were obtained when using straight Coal Tar, those on March 15th to 17th, inclusive were using Smelter fuel oil and Barrett No. 4 oil, while those on March 20th to 26th inclusive were obtained when using Flotaco No. 20 and No. 21 oil with small amounts of Pine oil. The results on January 17th and 18th and March 15th to 17th and March 20th to 26th were obtained at No. 1 Pyramid as a Roughing Machine followed by the Air Machine as cleaners, thus giving the rougher concentrate a double recleaning. This flow sheet is similar to our installation when operating with less than 1 pound of oil per ton. Hayden, Mar. 29th, 1917.

(Signed) E. W. ENGELMANN,
Flotation Foreman.

Defendant's Exhibit No. 153.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Defendant's E

RAY CONSOLIDATED
HaydenCOMPARATIVE RESULTS OBTAINED ON AIR MACHINE
MORE THAN 1% OF OIL PER TON AND AIR
SAME OIL MIXTURE

DATE	Product Treated	Kind of Oil	Original Lbs. Oil Per Ton
Mar. 30, 31 and April 1.....	Retreating Plant Feed	90% Fuel and 10% Barrett No. 4	22.24
April 3d, 4th and 5th.....	Retreating	90% Fuel and 10% Barrett No. 4	11.27
Mar. 30th, 31st and Apr. 1st.....	Slime Vanner Tailing	Straight Coal Tar	22.41
Apr. 3d, 4th and 5th.....	Slime Vanner Tailing	Straight Coal Tar	11.20

RESULTS OBTAINED WHEN ELIMINATING

Apr. 7th	Retreating Plant Feed	Straight Barrett No. 4	2.39
Apr. 8th	Retreating Plant Feed	Straight Barrett No. 4	1.31
Apr. 7th	Slime Vanner Tailing	Straight Barrett No. 4	2.07
Apr. 8th	Slime Vanner Tailing	Straight Barrett No. 4	1.13

NOTE—The oils used on retreating machine were as indicated above. The only variation from oil mixtures indicated was an oil
This pine was never used continuously and was of so minute a quantity that the operator failed to record same. This practice, I
NOTE 2—

Pine oil is never used in this manner on machines treating our flotation slime feed.

When using straight Barrett No. 4, the bubble is brittle and somewhat delicate and has a tendency to burst when coming to the
carrying oil, but the latter characteristic is not sufficient to strengthen the bubble enough to carry the larger mineral particles, espe

When using mixtures of Barrett No. 4 and Fuel Oil, the latter has the faculty of strengthening the creosote bubble sufficient
Hayden, Ariz., Apr. 9th, 1917.

Copied Butte Apr. 23d.

Exhibit No. 154.

COPPER COMPANY

Plant
 AND RETREATING MACHINES WHEN CONSUMING
 SO $\frac{1}{2}$ OF 1% OIL PER TON, USING THE
 RE THROUGHOUT.

HEADING		CONCENTRATE		Tails Assay % Cu.	Indi- cated Extrac- tion %	% Solids	Pounds Oil per Ton Heads Incl. Cir. L.	PERCENT OIL	
Tonnage	Assay % Cu.	Tonnage	Assay % Cu.					Concts.	Tails
1125	6.14	309	21.48	.326	96.14	23.60	20.90	3.25	.035
1133	6.24	321	21.28	.290	96.67	22.23	10.80	1.82	.022
795	.687	33	7.75	.375	47.63	24.19	22.83		
772	.660	22	10.64	.366	46.15	25.81	10.95	3.95	.445

ING FUEL OIL FROM OIL MIXTURES

344	6.30	63	29.56	1.083	85.95	20.47			
356	6.20	54	34.16	1.25	82.89	20.35			
245	.676	4	12.56	.456	33.65	26.63			
273	.720	3	18.13	.543	25.39	27.81			

occasional addition of a small amount of pine oil when an unusual amount of coarse feed entered the machine.
 However, was maintained throughout entire tests regardless of amount of original oil mixture added at head of machine.

surface, thus causing the coarse mineral particles to drop. This oil is a very good frothing agent and also acts somewhat as a
 sially when acting in feeds carrying large percentages of mineral.
 to carry mineral particles which would ordinarily drop if using straight Barrett No. 4.

(Signed) E. W. ENGLEMAN
 Flotation Foreman

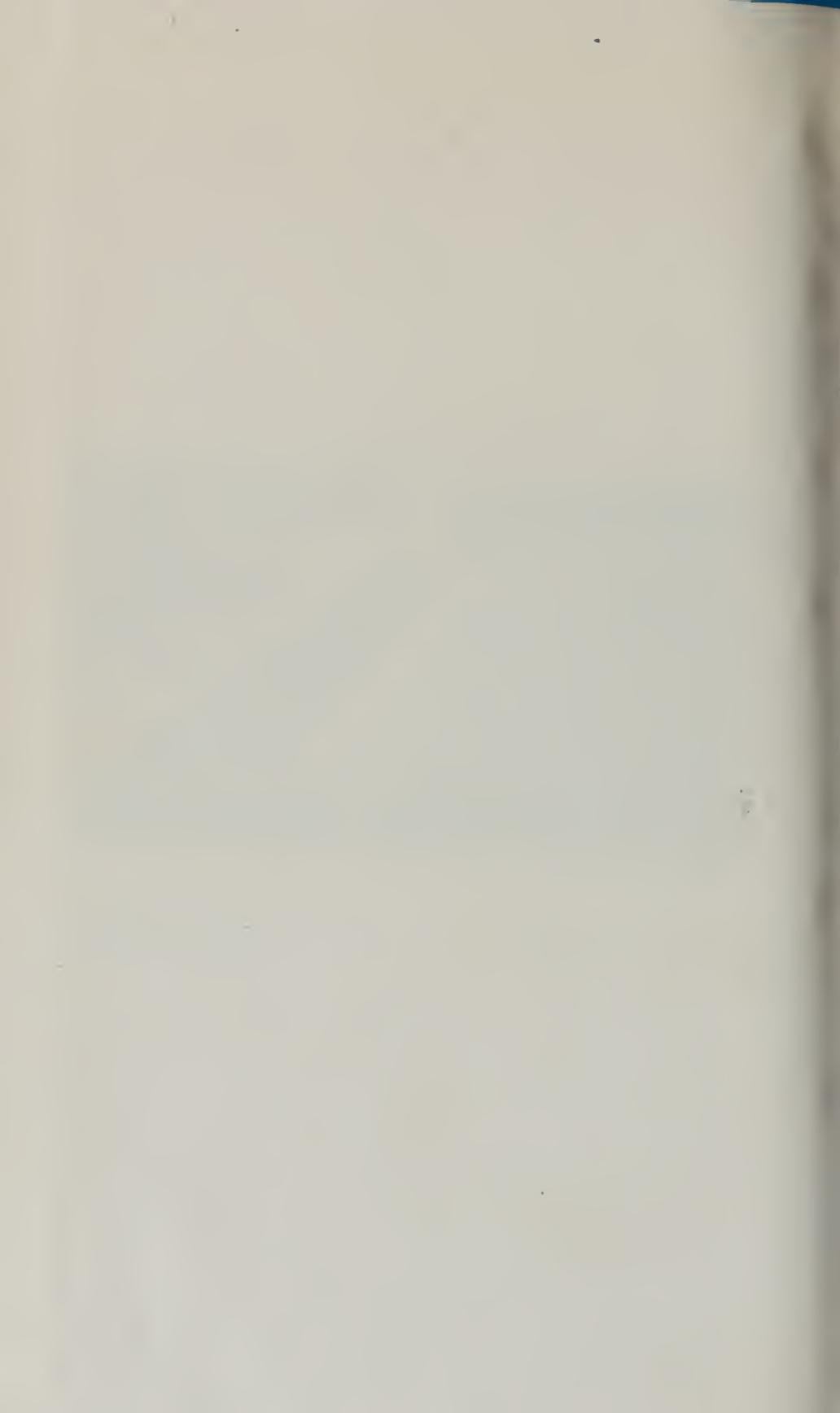
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.



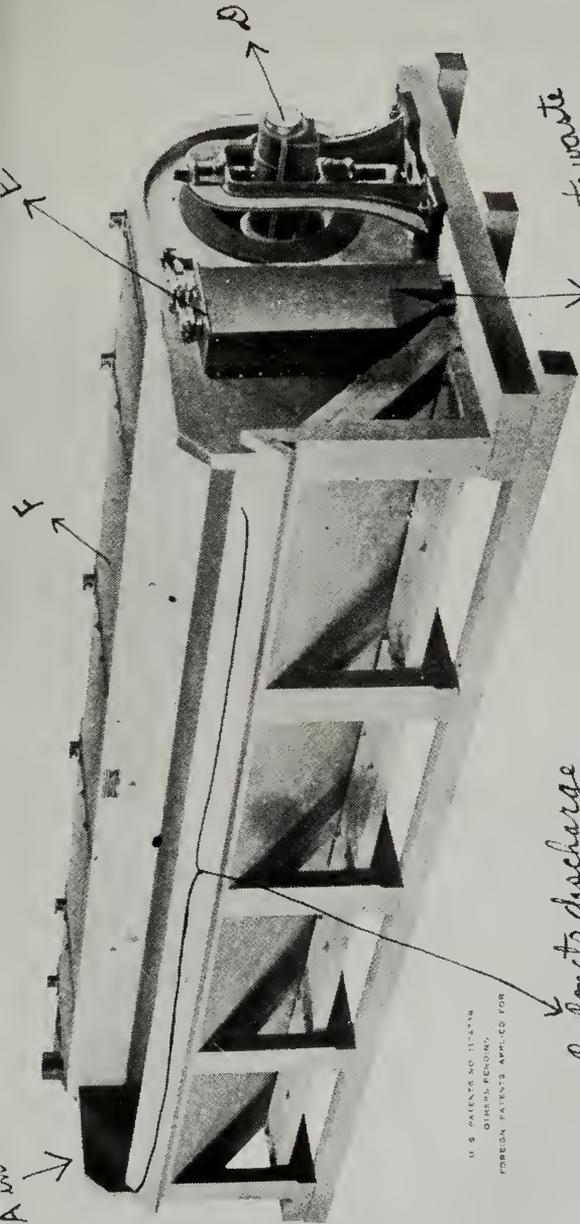
Defendant's Exhibit No. 155.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Defendant's Exhibit No. 156.



C. Con'ts discharge

B Tailing to waste

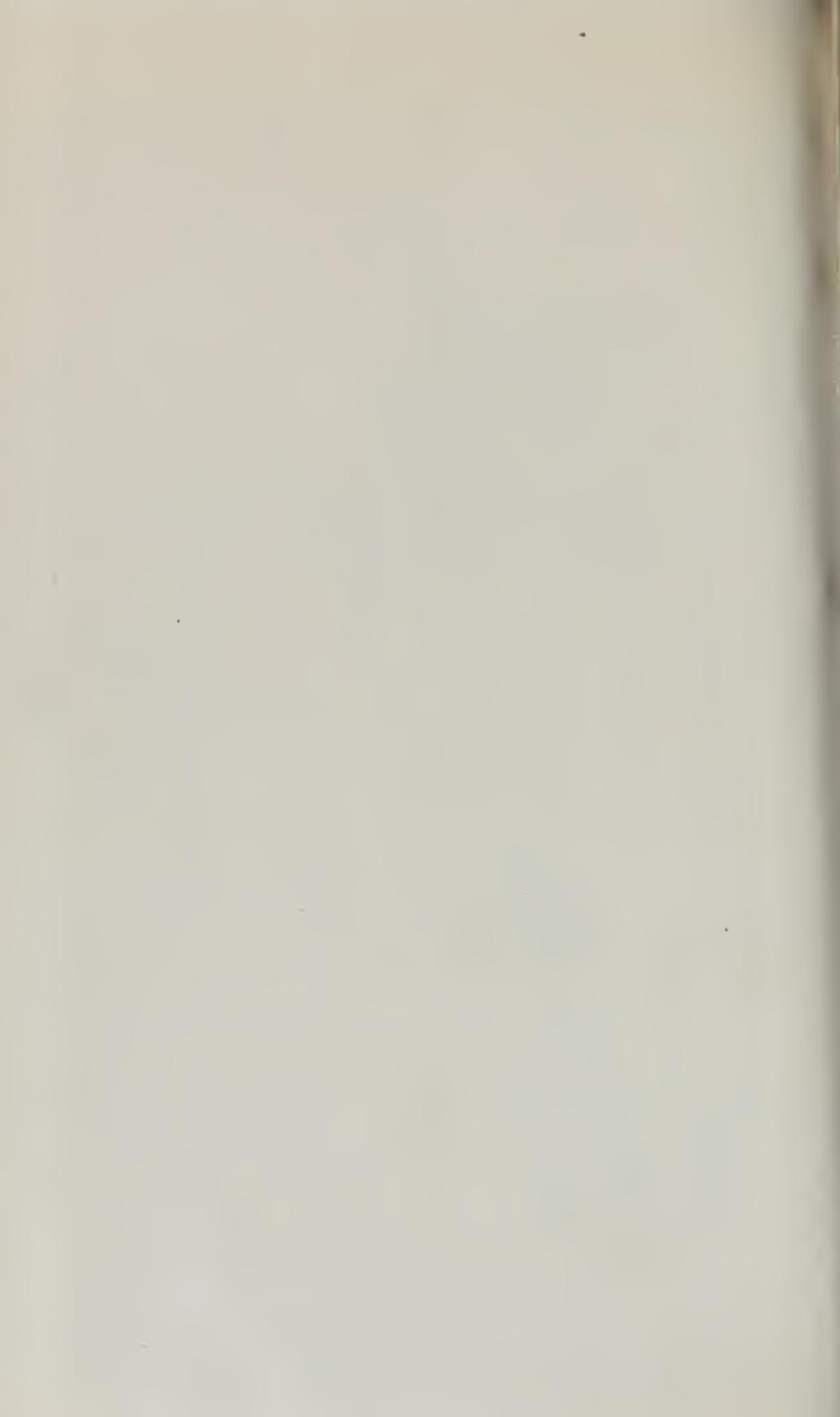
U. S. PATENTS NO. 117,474
OTHER PATENTS PENDING
FOREIGN PATENTS APPLIED FOR

STANDARD K. & K. FLOTATION MACHINE

TYPE A 2612
SOUTHWESTERN ENGINEERING CO., LOS ANGELES, CAL.

COMPLETE UNIT	3' x 15'
NO BLOWER	
NO COMPRESSED AIR	
CAPACITY	80 TO 130 TONS
POWER	8 TO 10 H. P.
NO PREAGITATORS	

PRICE F. O. B. LOS ANGELES }
 Steel Construction, wt. 3500 lbs. \$1100 }
 Wood Construction, wt. 3300 lbs. 800 }



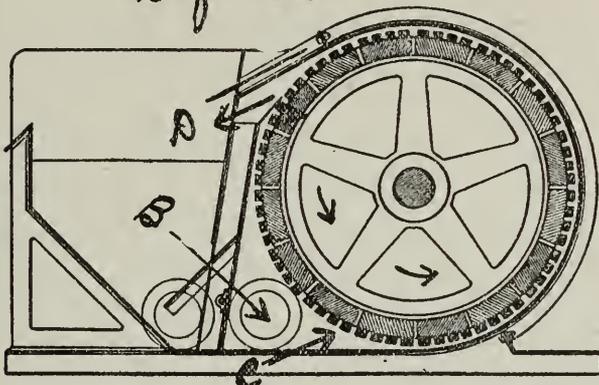
Defendant's Exhibit No. 157.

(Page One)

THE K & K FLOTATION MACHINE

— BULLETIN NO. 1 —

Def. Ex 157



U. S. PATENTS 1174739

OTHERS PENDING

Foreign Patents Applied for.

SOUTHWESTERN ENGINEERING CO.,

Consulting Mining, Metallurgical, Mechanical
and Electrical Engineers.

523-524 Wesley Roberts Building,
LOS ANGELES, CALIFORNIA.

Mine Examination
Ore Treatment Problems
Ore Testing Laboratory
Concentration and Flotation Tests

Defendant's Exhibit No. 157.

(Page Two)

D. D. BISBEE Elect., & Mech., Engineer
L. C. Penhoel, Mining Engineer
Max Kraut, Metallurgical Engineer

(Page Three)

DESCRIPTION.

The Machine consists essentially of a long, hollow, cylindrical drum, mounted on a horizontal shaft. This drum is provided with a series of longitudinal air slots and a larger number of longitudinal riffles running the entire length of the drum. The drum is rotated rapidly inside of a close fitting casing and the whole enclosed in a suitable housing as shown in the accompanying illustration. A discharge lip placed tangentially to the periphery of the drum provides for taking the pulp into the frothing box and a controllable intake passage at the bottom of the frothing box provides for returning the pulp to the aeration chamber for retreatment.

OPERATION.

The machine is very simple, having automatic tailings discharge and level control. One man can take care of any number of machines.

ADAPTABILITY

Machine can be run in the ordinary flow sheet in flotation work, or else can be run as an independent unit adding the oil directly to the machine.

LABOR AND CARE.

The machine is self regulating and requires no attention outside of keeping the bearings oiled properly.

Defendant's Exhibit No. 157.

(Page Four)

SOME SUPERIOR POINTS.

1. Large capacity in a comparatively small floor space.
2. Little head room required.
3. Simplicity of construction.
4. Automatic control of machine, requiring little or no attention.
5. Low power consumption, due to the fact that churning and agitation are avoided, and air taken in at atmospheric pressure by suction.
6. Only wearing parts are riffles, which when worn out can be readily replaced.
7. Sands do not interfere with working of machine.
8. Settling of sands in frothing box and choking of machine is impossible.
9. With some ores machine can be operated as an independent unit, the oil being fed directly into machine.
10. Machine has no stuffing boxes and therefore no friction losses except in bearings.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's

BUTTE AND SUPERIOR
FLOTATION

PERIOD	Flot. Plant Feed		Flotation Machine Feed	Flot. Concts.		Fl. Tail
	Ore to Flot. Plant		(Ore to Flot. Plant plus Circulating Middling Treated in Flotation)	Dry Tons	Per Cent Zinc	Per Zi
	Dry Tons	Per Cent Zinc	Per Cent Zinc			
1913						
1st quarter.....	47,555	16.43		11,089	45.76	7.4
2nd quarter	49,698	15.28		13,811	46.09	3.0
3rd quarter	72,935	15.42		19,871	48.19	2.8
4th quarter	85,939	14.05		20,836	49.63	2.7
Year	256,127	15.14		65,607	47.80	4.0
1914	287,247	14.14		64,420	53.03	2.3
1915	471,478	13.66		107,348	54.82	1.7
1916						
3rd quarter	126,417	12.89		28,882	53.92	1.0
Year	583,937	13.36		133,785	53.83	1.2
Dec. 22, 1916-						
Jan. 7, 1917.....	23,901	12.64		5,222	51.72	1.4
Jan. 9-16	14,651	12.87		2,680	48.22	4.1
Jan. 17-29	19,158	13.48		4,587	47.68	2.1
Jan. 30-Feb. 3.....	8,863	12.36		2,211	49.06	1.6
Jan. 7-Feb. 6.....	47,852	12.99		10,546	48.45	2.7
Feb. 4-28	36,262	13.29	20.25	8,556	46.69	1.9
Mar. 1-20	30,231	12.72	22.70	7,194	47.50	1.5
Mar. 21-31	17,142	12.55	29.18	3,651	47.40	2.8
Apr. 1-15	24,298	13.09	22.42	5,852	46.32	2.3

Filed May 18, '917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

No 158.

COMPANY
ICIS

OIL—AMOUNT AND ANALYSIS

Zinc Recovery	Acid Pounds Per Ton	Per Ton Ore to Flotation		Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil Per Ton Contained in Ore & Circulating Middling Treated in Flot.	Per Cent Oil in Concs.	Per Cent Oil in Tailings
		Pounds Added	Per Cent Added				
Estimated							
64.56	1.68	4.76	0.24				
83.86	3.41	9.82	0.49				
85.16	7.05	4.14	0.20				
85.62	8.45	4.78	0.24				
80.87	5.60	5.58	0.28				
84.12	12.00	2.22	0.11				
90.36	7.81	1.49	0.07				
92.73	5.38	1.67	0.08				
92.33	5.25	1.43	0.07				
89.50	3.16	3.06	0.15				
68.60	20.55	24.90	1.24				
84.70	13.41	16.75	0.84				
99.20	11.65	16.05	0.80				
82.30	14.70	20.23	1.01				
82.86	10.29	20.07	1.00	1.27	25.40	1.86	0.55
88.87	9.81	21.30	1.06	1.50	30.00	2.29	0.69
80.46	10.15	22.86	1.14	1.56	31.20	2.45	0.71
85.21	9.98	23.91	1.19	1.34	26.80	2.09	0.70

Defe

BUTTE AN
FLOTATION PLANT RE

DATE	Flotation Plant Feed		Flotation Machine Feed		Flot. Concentrates	
	Dry Tons	Per Cent Zinc	(Ore to Flot. Plant plus Circulating Middling Treated in Flotation) Per Cent Zinc	Dry Tons	Per Cent Zinc	
Jan. 9	1,837	11.62	21.40	163	51.80	
Jan. 10	1,690	13.46	20.90	262	50.90	
Jan. 11	953	12.20	19.10	180	44.20	
Jan. 12	1,564	11.16	25.20	244	46.80	
Jan. 13	1,288	13.12	22.90	279	47.30	
Jan. 14	1,065	13.27	18.40	269	45.40	
Jan. 15	1,502	12.72	21.20	319	45.50	
Jan. 16	1,381	11.60	21.30	303	44.30	
Jan. 17	1,352	12.72	19.30	311	47.00	
Jan. 18	1,468	13.02	17.60	336	48.10	
Jan. 19	1,397	14.73	14.70	360	50.20	
Jan. 20	1,525	14.26	16.70	403	49.50	
Jan. 21	1,537	14.47	15.80	428	45.60	
Jan. 22	1,600	14.26	16.90	465	43.60	
Jan. 23	1,579	13.90	16.00	384	47.50	
Jan. 24	1,667	13.28	20.00	365	49.10	
Jan. 25	1,591	13.70	22.10	305	51.20	
Jan. 26	267	10.80	22.20	37	46.50	
Jan. 27	1,786	12.45	17.00	389	46.70	
Jan. 28	1,868	12.69	14.20	435	45.90	
Jan. 29	1,492	13.14	14.20	369	47.40	
Jan. 30	1,525	10.42	15.30	317	48.00	
Jan. 31	1,841	12.37	19.40	594	50.10	
Jan. 9-31	33,775	12.91	18.77	7,517	47.52	26

W.A.S.
T.F.S.
J.B.K.
D.C.H.
B.H.D. 2
J.L.B.

April 14th, 1917.

Filed May 18, 1917
GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

b. No. 159.

MINING COMPANY

JANUARY, 1917

OIL—AMOUNTS AND ANALYSIS

Flot. Zinc Recovery		Per Ton Ore to Flotation		Pounds Oil per Ton Contained in Ore & Circulating Middling Treated in Flotation	Per Cent Oil in Circulating Middling Treated in Flotation	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
pparent	Estimated	Pounds Added	Per Cent Added					
44.63	39.57	10.80	0.540	2.63	52.60	1.46	1.80	1
59.64	58.61	16.25	0.812	2.47	49.40	1.88	2.28	2
75.04	68.42	10.95	0.548	3.28	65.60	1.40	3.45	3
67.36	65.44	16.82	0.841	0.66	13.20	1.95	2.57	4
83.60	78.08	16.09	0.804	1.31	26.20	1.53	0.98	5
89.48	86.43	22.55	1.128	1.92	38.40	2.44	1.37	6
81.48	75.97	16.71	0.835	1.19	23.80	1.36	0.97	7
83.85	83.77	21.09	1.054	1.26	25.20	1.92	0.85	8
88.65	84.96	12.46	0.623	1.32	26.40	1.09	1.49	9
87.39	84.58	13.83	0.697	2.43	48.60	1.63	1.16	10
94.30	87.75	16.68	0.834	1.72	34.40	1.77	1.20	11
92.75	91.73	13.10	0.655	1.34	26.80	1.87	1.09	12
92.32	87.73	9.98	0.499	1.30	26.00	2.22	1.10	13
92.51	88.87	15.45	0.773	1.62	32.40	1.90	1.16	14
85.31	83.11	18.29	0.914	1.29	25.80	0.91	1.57	14
83.25	80.93	16.58	0.829	2.56	51.20	3.26	2.39	15
74.58	71.63	18.32	0.916	1.89	37.80	2.43	1.79	16
65.45	59.64	11.27	0.563	2.32	46.40	1.81	1.43	17
87.49	81.73	11.93	0.597	2.11	42.20	2.14	1.94	18
93.57	84.20	15.01	0.750	1.33	26.60	1.91	1.17	18
94.09	89.18	8.06	0.403	1.36	27.20	1.61	1.87	18
90.67	95.80	14.02	0.701	0.56	11.20	1.08	0.25	18
87.12	130.70	12.63	0.632	0.60	12.00	1.41	0.26	18
83.02	81.92	14.75	0.738	1.67	33.40	1.40	1.49	

Defendant's Exhibit No. 160.

BUTTE AND SUPERIOR MINING COMPANY

Below is a statement of the percentages of oils in the various mixtures used in the flotation plant during the months of January, February and March, as well as April.

No.	Kero-sene	Jones Crude	No. 1 Creosote	No. 2 Creosote	Fuel	Pine	No. 4 Bar. rett	Tar	Par-affine Base
1	60%	%	15%	25%	%	%	%	%	%
2	67		3	29		1			
3			83	10		7			
4	61	2	34			1		2	
5	78		4	18					
6	70	3		27					
7	72		3	20					
8	74					3	2		
9	75					14	12		
10	55	7		2		20	5		
11	38	40				34	1		
12	64	30	1	2		18	4		3
13	60	14							15
14	31	59				11			
15	42	46				10			
16	28	62	1			12			
17	40	51		1		9			
18	21	69				8			
19	25	18	49			10			
20	27	7	60			8			
21	28	24	12	36		6			
22	47	8		4	31	10			
23					84	16			
24					95	5			
25	17				71	12			
26	10				85	5			
27	23	72				5			
28	10	70				20			
29	2				92	6			
30	10				80	10			
31	10				75	15			
32	8	45			31	16			
33		41			48	11			
34	22	39			24	15			
35	13	2			61	24			
36	35				50	15			
37	20				65	15			
38					80	20			
39	15				65	20			
40	15				75	10			
41	5	75			10	10			
42	10	55			15	20			
43	10	50			20	20			
44	10	10			65	15			
45	10				75	15			
46	5		15		70	10			
47	5		35		50	10			
48	10		10		70	10			
49	20				70	10			
50	18		2		70	10			
51	9	32	3		38	18			
52	10	70			5	15			
53	10	40			40	10			

April 19th, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defenda

BUTTE AND S
FLOTATION PLANT RECORD

DATE	Flotation Plant Feed		Flotation Machine Feed (Ore to Flot. Plant plus Circulating Middling Treated in Flotation) Per Cent Zinc	Flot. Concentrates		
	Dry Tons	Per Cent Zinc		Dry Tons	Per Cent Zinc	Dry Tons
Feb. 1.....	1,863	12.114	18.90	401	50.20	1,462
Feb. 2.....	1,608	13.465	15.30	413	49.00	1,195
Feb. 3.....	1,981	14.150	17.40	486	48.00	1,495
Feb. 4.....	1,843	11.750	18.50	356	50.70	1,486
Feb. 5.....	1,628	13.296	18.50	373	50.20	1,255
Feb. 6.....	1,709	12.795	20.80	359	51.20	1,350
Feb. 7.....	1,705	12.559	20.20	337	50.90	1,368
Feb. 8.....	1,768	12.712	20.20	320	51.30	1,448
Feb. 9.....	1,562	13.384	20.30	319	52.30	1,243
Feb. 10.....	1,175	14.270	24.30	282	51.40	893
Feb. 11.....	530	11.825	15.40	125	47.20	405
Feb. 12.....	1,430	13.191	19.50	321	49.20	1,109
Feb. 13.....	1,454	11.763	24.10	236	50.70	1,218
Feb. 14.....	1,373	11.404	24.50	255	51.70	1,118
Feb. 15.....	1,535	12.771	20.90	324	47.70	1,211
Feb. 16.....	1,455	10.557	21.00	276	46.80	1,179
Feb. 17.....	1,478	12.778	22.00	322	49.40	1,156
Feb. 18.....	1,470	13.900	18.80	370	44.40	1,100
Feb. 19.....	1,448	12.462	18.00	333	44.80	1,115
Feb. 20.....	1,552	12.954	15.50	426	46.50	1,126
Feb. 21.....	1,779	13.985	19.00	490	47.00	1,289
Feb. 22.....	1,756	13.687	20.90	398	51.30	1,358
Feb. 23.....	1,658	15.350	22.00	412	51.70	1,246
Feb. 24.....	1,769	14.312	24.40	454	48.60	1,315
Feb. 25.....	1,353	13.398	18.10	385	43.60	968
Feb. 26.....	1,662	14,043	17.10	489	43.20	1,173
Feb. 27.....	1,219	15,780	19.00	428	41.30	791
Feb. 28.....	1,794	14.645	21.50	522	43.90	1,272
Month	43,557	13.190	19.70	10,212	48.10	33,344

W.A.S.

T.F.S.

J.B.K.

D.C.J.

J.L.B.

B.H.D. 2

April 4, 1917.

No 161.

COMPANY

FEBRUARY, 1917

OIL—AMOUNTS AND ANALYSIS

Fl Zinc Recovery	Per Ton Ore to Flotation		Per Cent Oil in Ore and Cir- culating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Circulating Middling Treated in Flotation	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.	
	Estimated	Pounds Added						Per Cent Added
	89.20	10.77	0.539	0.64	12.80	1.45	0.30	18
	93.46	13.94	0.697	0.70	14.00	1.34	0.31	18
	87.64	17.78	0.889	0.73	14.60	1.36	0.47	19
	83.38	19.83	0.992	0.74	14.80	1.12	0.42	20
	86.50	20.99	1.050	0.79	15.80	1.12	0.46	19
	84.06	24.31	1.215	0.78	15.60	1.04	0.69	19
	80.11	19.03	0.952	0.76	15.20	1.34	0.50	19
	73.04	16.86	0.843	0.79	15.80	1.10	0.55	21
	79.80	19.65	0.983	0.75	15.00	1.53	0.43	22
	86.45	20.75	1.038	1.08	21.60	2.10	0.54	23
	94.14	15.34	0.767	0.85	17.00	1.59	0.30	24
	83.73	16.24	0.812	1.14	22.80	2.31	0.52	24
	69.96	19.62	0.981	1.36	27.20	2.66	0.73	25
	84.20	13.93	0.696	1.12	22.40	2.49	0.47	26
	78.83	16.57	0.829	0.99	19.80	2.24	0.42	26
	84.09	24.86	1.243	1.27	25.40	1.94	0.56	27
	84.22	22.05	1.102	1.24	24.80	1.95	0.71	27
	80.40	21.80	1.090	1.74	34.80	1.94	0.60	27
	82.71	21.40	1.070	2.02	40.40	2.02	0.66	27
	98.53	21.56	1.078	2.51	50.20	1.93	0.56	28
	92.56	17.69	0.885	1.24	24.80	1.87	0.59	28
	84.95	20.22	1.011	2.85	57.00	2.29	0.54	29
	83.69	14.97	0.749	1.35	27.00	2.47	0.59	30
	87.15	24.13	1.207	1.05	21.00	2.08	0.46	31
	92.60	22.41	1.120	1.13	22.60	1.66	0.44	32
	90.51	24.17	1.209	1.17	23.40	1.69	0.45	32
	91.90	20.85	1.042	1.14	22.80	1.61	0.62	33
	87.22	19.30	0.905	1.26	25.20	1.90	0.68	34
	85.49	19.33	0.967	1.18	23.60	1.77	0.52	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendan

BUTTE AND SUI
FLOTATION PLANT RECORD

DATE	Flotation Plant Feed		Flotation Machine Fee (Ore to Flot. Plant plus Circulating Middling Treated in Flotation)	Flot. Concentrates		Flot. Tailings	
	Dry Tons	Per Cent Zinc	Per Cent Zinc	Dry Tons	Per Cent Zinc	Dry Tons	Per Cent Zinc
Mar. 1.....	1 628	14.48	21.60	479	45.40	1 148	1
2.....	1 781	15.02	24.50	512	47.30	1 269	1
3.....	1 478	13.15	25.70	346	48.60	1 152	1
4.....	1 521	12.94	21.30	372	47.30	1 149	1
5.....	1 523	12.52	23.90	342	50.50	1 181	1
6.....	1 510	13.18	24.10	375	48.30	1 135	1
7.....	1 457	13.25	20.40	377	45.20	1 082	1
8.....	1 281	11.90	21.70	297	46.70	984	1
9.....	1 453	12.18	20.50	331	47.00	1 122	1
10.....	1 541	13.32	21.40	394	46.20	1 147	1
11.....	1 421	11.84	21.40	307	48.60	1 114	1
12.....	1 321	12.20	27.20	267	51.50	954	2
13.....	1 445	13.60	29.20	327	51.10	1 118	2
14.....	1 557	13.30	30.00	344	49.30	1 213	2
15.....	1 703	11.85	22.50	363	47.40	1 340	1
16.....	1 857	11.04	19.80	405	47.00	1 452	1
17.....	1 623	12.31	20.00	392	45.10	1 231	1
18.....	1 105	11.99	15.70	269	46.40	836	1
19.....	1 477	12.15	18.90	363	44.00	1 114	1
20.....	1 549	11.80	24.30	332	47.20	1 217	1
21.....	1 473	13.84	23.30	365	47.60	1 108	2
22.....	1 598	11.82	25.80	228	44.90	1 370	6
23.....	1 476	13.56	19.80	406	41.30	1 070	2
24.....	1 549	12.78	22.00	345	45.10	1 204	3
25.....	1 470	12.25	22.00	346	44.30	1 124	2
26.....	1 451	12.24	29.00	319	48.00	1 132	2
27.....	1 421	12.52	30.00	300	50.00	1 121	1
28.....	1 557	13.41	32.70	360	50.60	1 197	2
29.....	1 706	11.83	29.80	335	50.30	1 371	2
30.....	1 667	12.16	27.70	324	49.50	1 343	2
31.....	1 774	11.89	29.70	323	50.70	1 451	3
Month	47 373	12.66	23.42	10 845	47.30	36 449	2

W.A.S.
T.F.S.
J.B.K.
D.C.J.
B.H.D.
J.L.B.

April 14th, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

0.162.

COMPANY

MARCH, 1917

OIL—AMOUNT AND ANALYSIS

ted	Per Ton Ore to Flotation		Per Cent Oil in Ore and Circulating Middling Treated in Flotation	Pounds Oil per Ton Contained in Ore & Middling Treated in Flot.	Per Cent Oil in Flotation Conc.	Per Cent Oil in Flotation Tailing	Oil Used No.
	Pounds Added	Per Cent Added					
26	19.76	0.99	1.17	23.40	1.64	0.62	35
56	29.44	1.47	2.76	55.20	2.71	0.68	36
51	21.66	1.08	1.23	24.60	2.28	0.61	37
42	17.52	0.87	1.28	25.60	2.01	0.57	38
61	23.42	1.17	1.28	25.60	1.98	0.62	39
04	18.72	0.94	1.30	26.00	2.11	0.54	40
24	25.28	1.26	1.15	23.00	1.97	0.50	40
99	20.00	1.00	1.29	25.80	2.14	0.63	40
94	21.90	1.09	1.44	28.80	2.34	0.74	40
66	20.83	1.04	1.88	37.60	2.86	0.69	40
66	22.57	1.13	1.52	30.40	2.64	0.58	40
31	20.09	1.00	1.20	24.00	2.45	0.66	40
03	19.20	0.96	1.62	32.40	2.55	0.65	40
62	24.23	1.21	1.45	29.00	2.66	0.53	40
78	21.73	1.08	1.59	31.80	2.52	0.63	41
80	20.73	1.04	1.35	27.00	2.22	0.74	42
51	18.81	0.94	1.48	29.60	1.92	0.87	43
22	25.71	1.28	1.91	38.20	1.66	1.16	42
02	21.26	1.06	1.55	31.00	2.40	1.01	44
73	19.62	0.98	1.47	29.40	2.71	0.91	45
21	23.74	1.19	1.72	34.40	2.94	1.15	45
19	23.59	1.17	1.77	35.40	2.93	0.76	46
78	22.11	1.10	1.85	37.00	3.09	0.55	47
58	23.59	1.18	1.47	29.40	2.64	0.69	48
14	21.56	1.08	1.41	28.20	2.48	0.77	49
20	21.94	1.09	1.49	29.80	2.83	0.67	49
30	23.54	1.18	1.55	31.00	2.64	0.67	49
23	22.85	1.14	1.38	27.60	2.61	0.76	49
50	24.97	1.25	1.41	28.20	2.41	0.58	50
09	21.66	1.08	1.35	27.00	2.43	0.71	50
63	21.86	1.09	1.71	34.20	3.36	0.80	50
60	22.08	1.10	1.52	30.40	2.45	0.71	

Defend

BUTTE & S

FLOTATI

MACHINE FEED						
Date	Machine No.	Ore		Concentrates	Tailings	% c Rec ry
		To Machines	Dry Tons			
		Dry Tons	% Zinc	% Zinc	% Zinc	Apr nt
12/29/1916	2	178	14.00	46.00	2.32	87
12/30/1916	1	108	13.20	47.60	1.35	92
12/30/1916	2	117	13.30	45.40	0.96	94
12/31/1916	1	160	12.20	46.20	2.38	84
12/31/1916	2	115	11.00	45.40	1.10	92
1/1/1917	1	153	11.10	42.90	0.99	93
1/1/1917	2	93	12.80	44.60	0.50	97
1/1/1917	8	76	13.10	42.70	1.51	91
1/2/1917	1	160	13.80	47.70	2.20	88
1/2/1917	2	140	14.20	46.50	1.95	90
1/2/1917	8	210	15.00	43.40	2.96	86
1/3/1917	1	167	13.10	44.20	1.60	91
1/3/1917	2	135	15.50	47.80	3.35	84
1/4/1917	1	117	14.10	44.50	1.44	92
1/4/1917	2	120	14.80	45.70	2.25	89
1/5/1917	1	130	11.00	41.90	0.91	93
1/5/1917	2	162	12.20	42.00	1.40	91
1/5/1917	8	173	14.40	43.50	2.96	85
1/6/1917	1	132	9.50	48.80	0.90	92
1/6/1917	2	213	14.90	48.80	2.21	89
1/6/1917	8	149	13.90	47.00	1.45	92
1/7/1917	1	128	8.40	46.20	0.80	92
1/7/1917	2	198	12.40	36.30	1.54	91
1/7/1917	8	240	15.70	50.10	1.56	92
1/8/1917	1	54	8.10	47.70	0.74	92
1/8/1917	2	103	11.70	44.70	1.26	91
1/8/1917	8	89	15.10	45.80	1.42	93

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

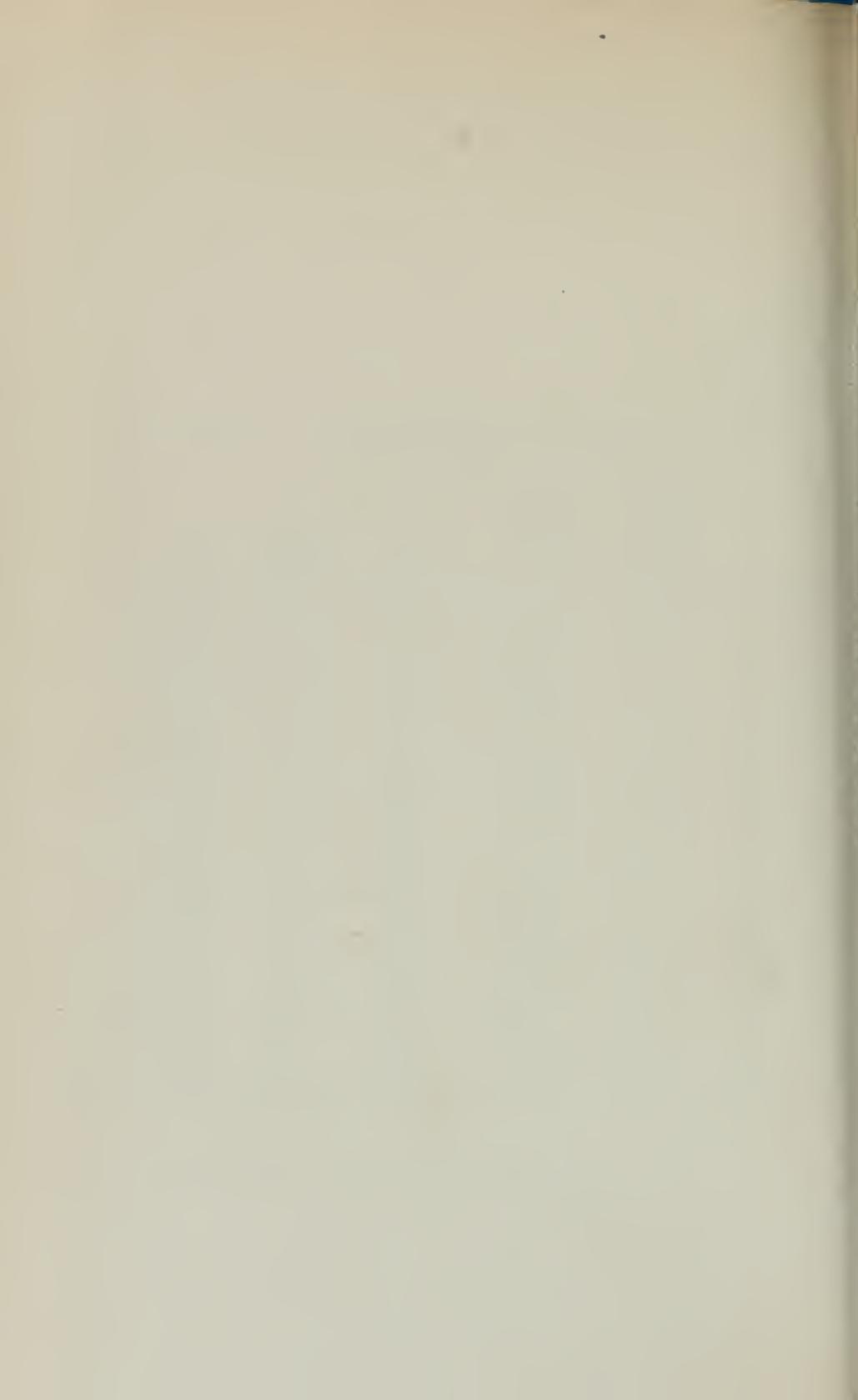
it No. 163.

ING COMPANY

D MACHINES

OIL---AMOUNT AND ANALYSIS

Per Cent Added	Per Cent Oil in Ore and Circulating Middling Treated in Machines	Pounds Oil per Ton in Ore and Circulating Middling Treated in Machines	Per Cent Oil in Concentrates	Per Cent Oil in Tailings	Oil Used No.
1.43	No Analysis	-----	No Analysis	No Analysis	1 A
1.68	3.32	66.40	2.57	1.10	2 A
1.64	1.84	36.80	2.42	0.86	3 A
1.20	3.27	65.40	2.67	1.77	4 A
1.78	1.24	24.80	1.40	2.26	5 A
1.43	1.54	30.80	2.12	1.11	4 A
2.26	1.01	20.20	3.13	1.11	5 A
3.15	2.94	58.80	2.62	2.72	6 A
1.38	1.59	31.80	1.78	1.49	7 A
1.49	2.66	52.20	1.84	2.47	5 A
1.10	1.94	38.80	1.53	1.75	8 A
1.60	2.89	57.80	1.61	0.35	9 A
1.23	2.37	47.40	1.38	1.30	10 A
2.06	1.79	35.80	2.17	1.60	11 A
1.70	2.50	50.00	1.34	0.82	5 A
1.25	2.62	52.40	1.56	2.17	12 A
1.22	1.31	26.20	2.39	0.91	5 A
1.16	3.24	64.80	2.17	0.94	13 A
1.84	2.11	42.20	2.08	0.54	14 A
0.97	3.26	65.20	1.47	0.66	5 A
1.37	1.93	38.60	1.87	1.39	13 A
1.71	1.55	31.00	2.56	0.55	14 A
1.12	1.25	25.00	2.12	0.51	15 A
0.81	3.10	62.00	1.40	0.83	16 A
1.78	2.13	42.60	2.19	1.40	14 A
0.65	1.82	36.40	1.66	0.63	14 A
1.09	4.39	87.80	1.24	1.45	14 A



Defendant's Exhibit No. 164.

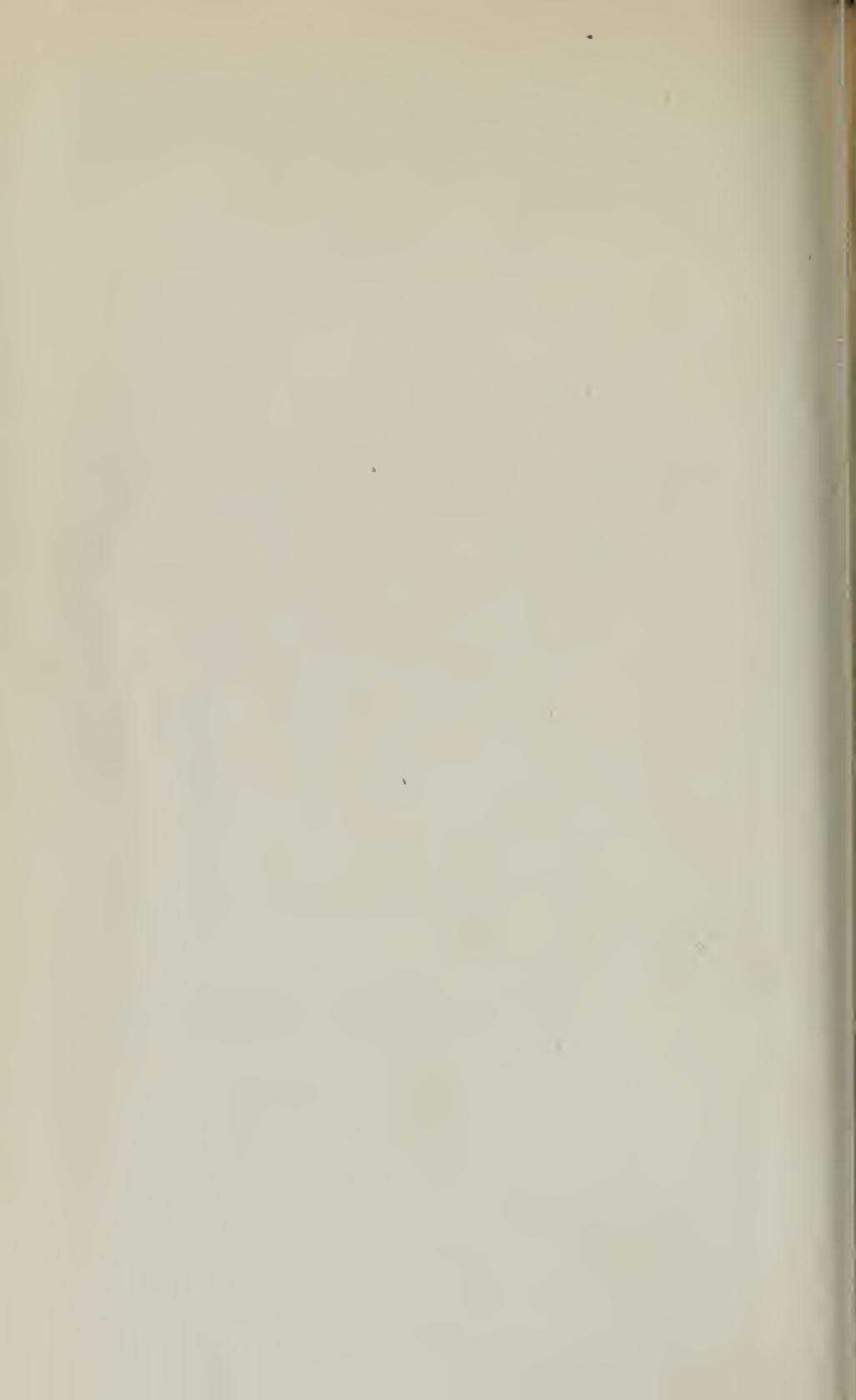
BUTTE AND SUPERIOR MINING COMPANY

is a statement showing the percentages of oils in the various mixtures used on the three pyarmid machines, while running them on experimental tests.

are	Kero- sene	Jones Crude	No. 1 Creosote	No. 2 Creosote	Fuel	Pinc	No. 4 Barrett	Tar	Paraffine Base
A	54			46					
A		98				2			
A	82			18					
A	30	70							
A	77			23					
A	67			7				26	
A	30	65		5					
A	77			8				15	
A	22	74		4					
A	91			9					
A		97		3					
A		87				13			
A	85			3				12	
A			100						
A	8		90	2					
A	1		97					2	

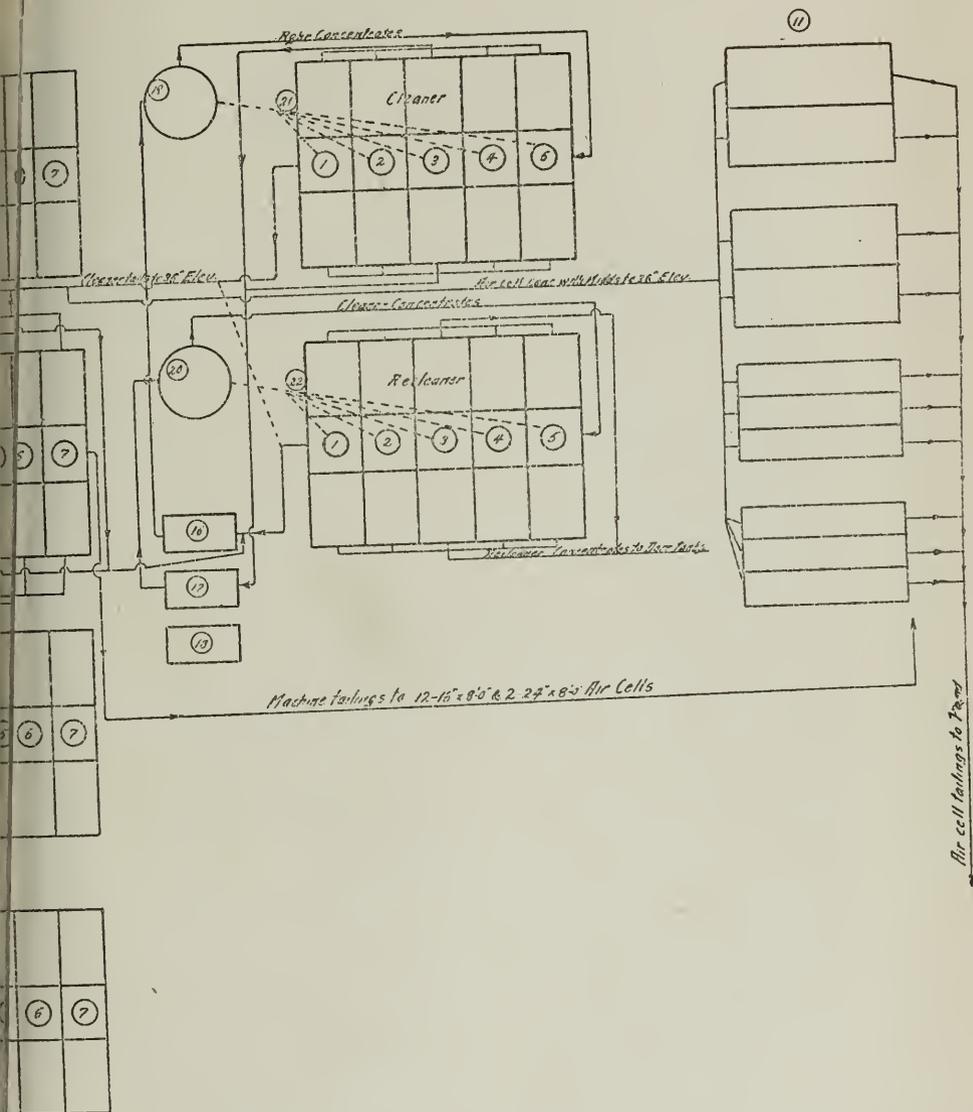
Butte, Montana,
April 17, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

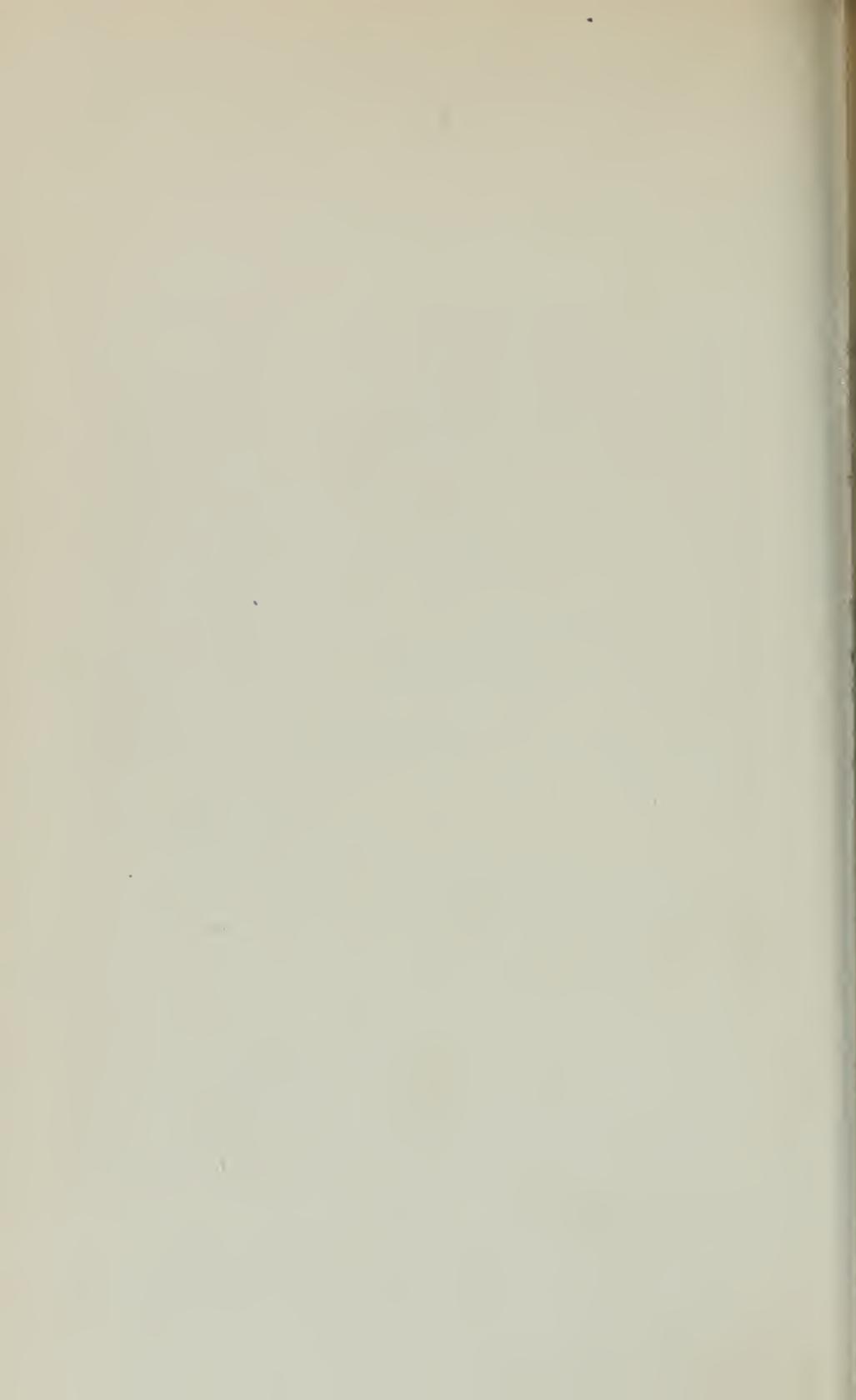


N. 165.

PLANT



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.



Defendant's Exhibit No. 166.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

J. M. Hyde, Dr.
Address Basin, Mont.

Expense account for July, 1911, @ \$5.00 per day,	155 00	
Third payment on Test Machine	10 00	
		165 00

Subject: AJF Clerk Approved: W Atwater Superintendent	Butte, Montana.....191.... Received from BUTTE & SUPERIOR COPPER CO. Ltd., One hundred sixty five and no/100 Dollars in full payment of the above account. Signature James M. Hyde \$165/00 Per..... Please sign original and duplicate and return promptly.
---	--

(endorsement)

ORIGINAL

Voucher No. 3409
Amount \$165.00
Check No.
Date Paid
To J. M. Hyde.

Month July, 1911.

DISTRIBUTION

Extraordinary Expense \$165.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 167.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, Dr.
 Address Basin, Mont.
 Expenses, month of August, 1911.
 31 das. @ \$5.00 per day, 155.00

Correct:

AJF Clerk

Approved:

M W Atwater
Superintendent

Butte, Montana....., 1911
 Received from BUTTE & SUPERIOR COPPER CO. Ltd., one hundred fifty-five & no/100 Dollars in full payment of the above account.
 \$155.00

Signature James M. Hyde
 Per.....

Please sign original and duplicate and return promptly.

(Endorsement)

8

ORIGINAL

Voucher No. 3495
 Amount \$155.00
 Check No. 2415
 Date Paid 8/8/11
 To J. M. Hyde.

Month August, 1911.

DISTRIBUTION

Concentrating

\$155.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk

By H. H. WALKER, Deput

Defendant's Exhibit No. 168.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, Dr.
Address Basin, Mont.

First payment on account of Hyde plant
installation 150.00

<p>Correct: JF Clerk</p> <p>Approved: I. W. Atwater, Superintendent</p>	<p>Butte, Montana, Sept. 22, 1911. Received from BUTTE & SUPERIOR COP- PER CO. Ltd., one hundred fifty and no/100 Dollars in full payment of the above account. \$150.00 Signature J. M. Hyde Please sign original and duplicate and return promptly.</p>
---	---

(Indorsement)

37

ORIGINAL

Voucher No. 3508
Amount \$150.00
Check No. 2444
Date Paid 9/21/'11
To J. M. Hyde.

Month September, 1911

DISTRIBUTION

Basin Concentrator Equipment, 150.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 169.

ORIGIN

BUTTE & SUPERIOR COPPER COMPANY
(Limited)To J. M. Hyde, Dr.
Address Basin, Mont.Second payment on account of Hyde
plant installation 150

Correct: A J F Clerk	Butte, Montana .....19.. Received from BUTTE & SUPERIOR CO PER Co. Ltd., one hundred fifty and no/1 Dollars in full payment of the above account Signature J. M. Hyde
Approved: M W Atwater Superintendent	\$150.00 Per..... Please sign original and duplicate and return promptly.

(Endorsement)

47

ORIGINAL

Voucher No. 35719.
Amount \$150.00
Check No. 2460
Date Paid 9/25/11
To J. M. Hyde

Month Sept., 1911.

DISTRIBUTION

Basin Concentrator Equipment 150.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Defendant's Exhibit No. 170.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

J. M. Hyde, Dr.
Address Basin, Mont.

Expense A/C at Basin at \$5.00 per day for
the month of September, \$150.00

Correct:
AJL Clerk

Approved:
M W Atwater
Superintendent

Butte, Montana, Oct. 26, 1911.
Received from BUTTE & SUPERIOR COP-
PER CO. Ltd. One hundred fifty & no/100
Dollars in Full payment of the above account.
\$150.00

Signature J. M. Hyde
Per.....
Please sign original and duplicate and return
promptly.

Endorsement)

68

ORIGINAL

Voucher No. 3584
Amount \$150.00
Check No. 2534
Date Paid Oct. 20, 1911.
To J. M. Hyde,
Month, September, 1911.

DISTRIBUTION

Concentrating \$150.00

(In pencil)

Get after Scott (Purchasing Dept) get 3/8x1 3/4 Elev. Bolts
instead of whatever is ordered

M W Atwater, Hotel Samuels, Wallace, Idaho.

Where are derrick irons? Are they shipped

When Where.

If not shipped cut out pulleys (all)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy

Defendant's Exhibit No. 171.

ORIGINAL

**BUTTE & SUPERIOR COPPER COMPANY
(Limited)**

To J. M. Hyde, Dr.
Address Auditorium Annex,

To third payment of Hyde Plant installation 5,000.00

Correct:

6 Clerk

Approved:

M. W. Atwater
Superintendent

Butte, Montana, Nov. 9, 1911.
Received from BUTTE & SUPERIOR
COPPER CO. Ltd., Five thousand and
no/100 Dollars in full payment of the
above account.

\$5,000.00

Signature J. M. Hyde.

Per.....

Please sign original and duplicate and re-
turn promptly.

(Endorsement)

ORIGINAL

Voucher No. 3610

Amount \$5000.00

Check No. 2553

Date Paid 10/26/11.

To J. M. Hyde.

Month, Oct., 1911.

DISTRIBUTION

Basin Concentrator Equipment 5000.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 172.

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde, Dr.
Address Basin, Mont.

To expense account for October, 1911.
26 das. @ \$5.00 per day 130.00

Correct: ----- Clerk. Approved: M W Atwater, Superintendent	<p style="text-align: right;">Butte, Montana, Nov. 9, 1911.</p> <p>Received from BUTTE & SUPERIOR COPPER CO. Ltd., One hundred thirty and no/100 Dollars in full payment of the above account. \$130.00</p> <p style="text-align: right;">Signature J. M. Hyde Per.....</p> <p>Please sign original and duplicate and return promptly.</p>
--	---

(Endorsement)

86

ORIGINAL

Voucher No. 3609
Amount \$130.00
Check No. 2552
Date Paid 10/26/11.
To J. M. Hyde.

Month, Oct., 1911.

DISTRIBUTION

Concentrating 130.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 173.

(Page 1)

EXPENSE ACCOUNT

Chicago Trip

J. M. HYDE

Butte to St. Paul (ticket, pullman, etc.)	\$ 42.50
Meals on train, porter, etc.	5.75
St. Paul to Chicago	10.50
Carriage in Chicago	4.00
Express charges on Test Machine	8.00
Deposit on motor (to be collected by Scott and deducted from his expense acc't).....	20.00
Carriage	3.50
Hotel	27.65
Chicago to Duluth	11.80
Duluth to Butte	37.85
Hotel at Duluth	3.00
Meals, Carriage, etc., Chicago & Train	38.30
Trip to Basin and return	3.80
Meals and incidentals at Butte	4.50
	\$230.15

Defendant's Exhibit No. 173

(Page 2)

ORIGINAL

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To James M. Hyde Dr.
Address.....

Account of expense trip Butte to Chicago and re-
turn, as per statement attached.....\$230.15 \$230.15

<p>Correct: A J F Clerk</p> <p>Approved: M. W. Atwater Superintendent</p>	<p>Butte, Montana.....19....</p> <p>Received from BUTTE & SUPERIOR COPPER CO. Ltd., Two hundred thirty & 15/100 Dollars in Full payment of the above account. \$230.15 Signature..... Per.....</p> <p>Please sign original and duplicate and re- turn promptly.</p>
---	--

(Endorsement)
72

ORIGINAL

Voucher No. 3764
Amount \$230.15
Check No. 2736
Date Paid Dec. 20, 1911
To James M. Hyde

Month November, 1911

DISTRIBUTION

Extraordinary ex. \$230.15

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 174.

Ent

ORIGINAL

J 46

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

To J. M. Hyde Dr.
Address Butte, Mont.

Expense Account dated	Jan. 31, 1912	\$383.65	
"	"	"	
"	Mar. 30, 1912	585.82	
			<u>\$969.47</u>
Less: Advance as Voucher 3998		600.00	
			<u>\$369.47</u>

Correct:
C.M.E.
Auditor

Approved:
M.W.A.
Superintendent

Butte, Montana.....19..
Received from BUTTE & SUPERIOR
COPPER CO. Ltd., Three Hundred Sixty
nine & 47/100 Dollars in Full payment of
the above account.
\$369.47 Signature James M. Hyde
Per.....
Please sign original and duplicate and re
turn promptly.

(Endorsement)

29

ORIGINAL

Voucher No. 4153
Amount \$369.47
Check No. 3153
Date Paid Mar. 30, 1912
To J. M. Hyde
Month March

DISTRIBUTION

Extraordinary Expense \$369.47

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 175.

Original

BUTTE & SUPERIOR COPPER COMPANY
(Limited)

o J. M. Hyde
Address Butte, Montana.

Dr.

Advance on Expenses \$400.00

CORRECT:
C.M.E.
Auditor

APPROVED:
M. W. A.
Superintendent

Butte, Montana, 19....
RECEIVED FROM BUTTE & SUPERIOR COPPER CO., Ltd.,
Four Hundred Dollars.
in Full payment of the above account.
\$400.00.

Signature James M. Hyde
Per.

Please sign original and duplicate and return promptly.

Endorsed on Back.

30

ORIGINAL

Voucher No. 4154
Amount \$400.00
Check No. 3154
Date Paid Apr. 17, 1912.
To J. M. Hyde
Month April.

DISTRIBUTION

Accts. Payable \$400.00

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 176.

No. 4550

BUTTE & SUPERIOR COPPER COMPANY
Limited.

Butte, Mont. July 8, 1912.

Pay to the order of J. M. Hyde,.....\$200.00
Two Hundred and No-100.....DOLLARS

BUTTE & SUPERIOR C. CO., LTD
(Signed) C. M. Everett
Special

To the **FIRST NATIONAL BANK**,
Butte, Mont.

Endorsed on back: "Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check."

(Signed) James M. Hyde.

Paid 7-9-12

BUTTE & SUPERIOR COPPER COMPANY. 4550
Limited.

Butte, Mont., July 8, 1912.

VOUCHER

Payable to J. M. Hyde,.....\$200.00
Two Hundred and No-100DOLLARS

Approved for payment
(Signed) C. M. Everett

DETAILS OF VOUCHER 4550

Expense Account200.00

DISTRIBUTION

Hyde Process Patent Right

No. 4550

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By **H. H. WALKER**, Deputy.

Defendant's Exhibit No. 177.

BUTTE & SUPERIOR COPPER COMPANY,
Limited

Butte, Montana, Nov. 21, 1912.

No. 5333

Pay to the Order of James M. Hyde, 602,50
Six Hundred Two and 50-100 Dollars

BUTTE & SUPERIOR COPPER COMPANY, Ltd.

By C. M. Everett.

Pay to the FIRST NATIONAL BANK Special.
Butte, Montana.

Stamped across face of check: "Paid, Dec. 10, 1912. The First National Bank of Butte, Butte, Montana. P."

Endorsed on back: "Your endorsement hereon constitutes receipt in full for account as per statement which you have detached from this check."

(Signed) James M. Hyde.

M. W. A.

The amount advanced Mr. Hyde is \$600.00.

April 17	400.00	on a-c.
July 8	200.00	"
	<hr/>	
	600.00	

PAID.

Paul.

Enter Hyde account for 602.50, balance due on trips to Washington and England. Details on attached statements, and pay at once.

M. W. A.

Defendant's Exhibit No. 177

Paul:

Please check amounts advanced Hyde and return.

M. W. A.

HAYDEN, STONE & CO.,

Bankers

New York-Boston.

New York, October 23, 1912.

JMH-M.

Mr. M. W. Atwater,

Butte & Superior Copper Co.,

Butte, Montana.

My dear Max:

In looking over my records I find that I did not present an account of the expenses of my trip to Washington this Spring; my memory is that you advanced me \$400 for expenses for that trip and \$200 on the London one, of course, you have a record of this. I enclose herewith an account, also the account of my trip from Butte to London and return to New York.

I have trimmed these expense accounts down so that they do not really represent the total necessary cost of my travels.

I shall probably be in New York for two weeks more as the opposition is rather slow in getting in their evidence, but I hope that by the end of that time everything will be complete in the matter of the present suit

Defendant's Exhibit No. 177

with the exception of the presentation of the case in court, and possibly some consultation between Mr. Scott and myself before the matter comes to trial.

You may address me care of Hayden, Stone & Co., 25 Broad Street, New York City.

Our friends, the enemy, are not at all happy nowadays and I will not be surprised if they make some overtures looking to a withdrawal of the suit. This is what they have done in other cases where they had a much better showing than they had with us.

Hoping that all is well with you and trusting that you will at any time call upon me when you feel that my services are necessary, I remain,

Yours very truly,

(Signed) James M. Hyde.

(Encl.)

EXPENSE ACCOUNT OF JAMES M. HYDE

Trip to Washington on Patent Suit

Leaving Butte—April 17, 1912.

Room for Byrnes at Napton	\$ 9.00
Materials	5.00
Gas	1.00
Ticket and Pullman, Butte to Washington.....	68.65
Taxi and Express	2.50
Meals and Porters	10.75
Hotel in Washington 23 days at \$6.....	138.00

Defendant's Exhibit No. 177,

Telegrams, materials, etc.	18.50
Ticket & Pullman to Butte	68.65
Meals, etc. to Butte	12.00
	<hr/>
	\$334.05

EXPENSE ACCOUNT OF JAMES M. HYDE

Trip to London on Patent Suit

Leaving Butte—July 18, 1912

Butte to New York, Ticket & Pullman.....	\$ 75.70
Meals and Porter to New York	18.00
Hotel, Taxi, etc. in New York	9.25
Passage to London S-S Geo. Washington.....	151.00
Steamer Expenses	10.00
London July 21-Sept. 5th, 45 days at \$10.....	460.00
Telegrams, messenger, etc.	24.50
Passage to New York, S-S Minnetonka	110.00
Expenses on Steamer	10.00
	<hr/>
	\$868.45

BUTTE AND SUPERIOR COPPER COMPANY
Limited

Butte, Mont. Nov. 21, 1912.

VOUCHER

PAYABLE TO James M. Hyde, \$602.50
 Six Hundred Two and 50-100 DOLLARS
 Approved for Payment
 (Signed) C. M. Everett

Defendant's Exhibit No. 177

DETAILS OF VOUCHER.

Expenses trip to Washington	Apr. 17	334.05	
" " "	London July 18-12	868.45	
			<hr/>
	Total	1,202.50	

Less:

Advance	Apr. 17th, 1912	400.00	
"	July 8th, 1912,	200.00	600.00
		<hr/>	<hr/>
Net Balance		602.50	602.50

DISTRIBUTION

Account Payable	602.50
General Office	
	No. 5333

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 178.

BUTTE & SUPERIOR COPPER COMPANY,
Limited

New York Office
25 Broad Street

July 31, 1913.

Mr. J. L. Bruce, Manager,

Butte & Superior Copper Company, Ltd.,
Butte, Montana.

Dear Sir:

I am enclosing herewith copy of a telegram received today from James M. Hyde, which I thought you would be interested in seeing.

Yours very truly,

(Signed) N. B. MacKelvie.

NBM..S

Enclosure.

C O P Y

Berkeley, California, July 30, 1913.

N. B. MacKelvie:

Have received word of decision from Kremer but no details. I take for granted that appeal will be filed. Am at your service for any conferences the occasion may require. Will expect matters under discussion to be held in abeyance until new and unexpected situation is taken care of.

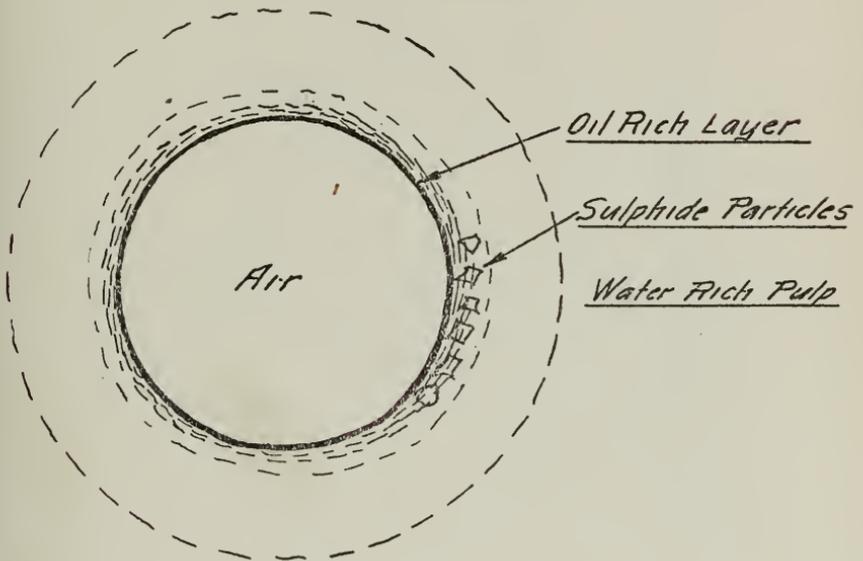
(Signed) James M. Hyde.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

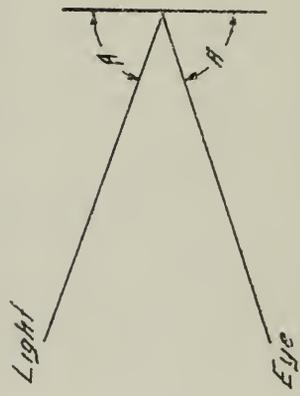
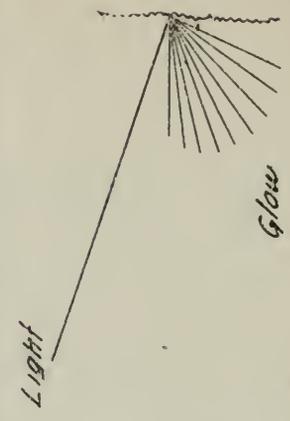
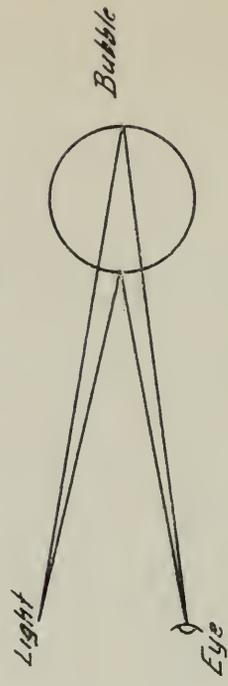
By H. H. WALKER, Deputy.

DIAGRAM NO. 22. DEF. EXHIBIT NO. 179 - A.F.T.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM No 23 DEF. EXHIBIT No. 180 - A.F.T.



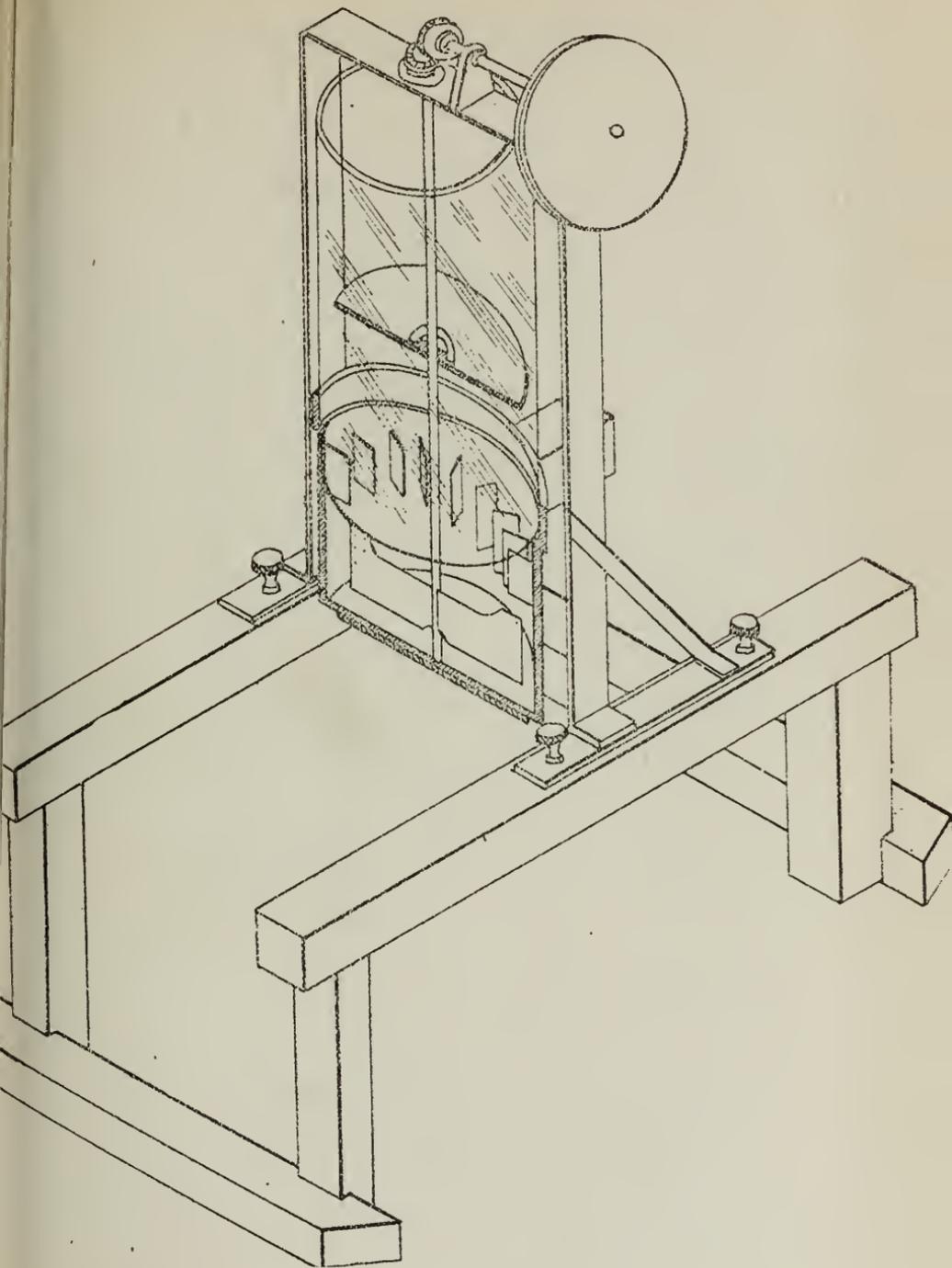
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 181.

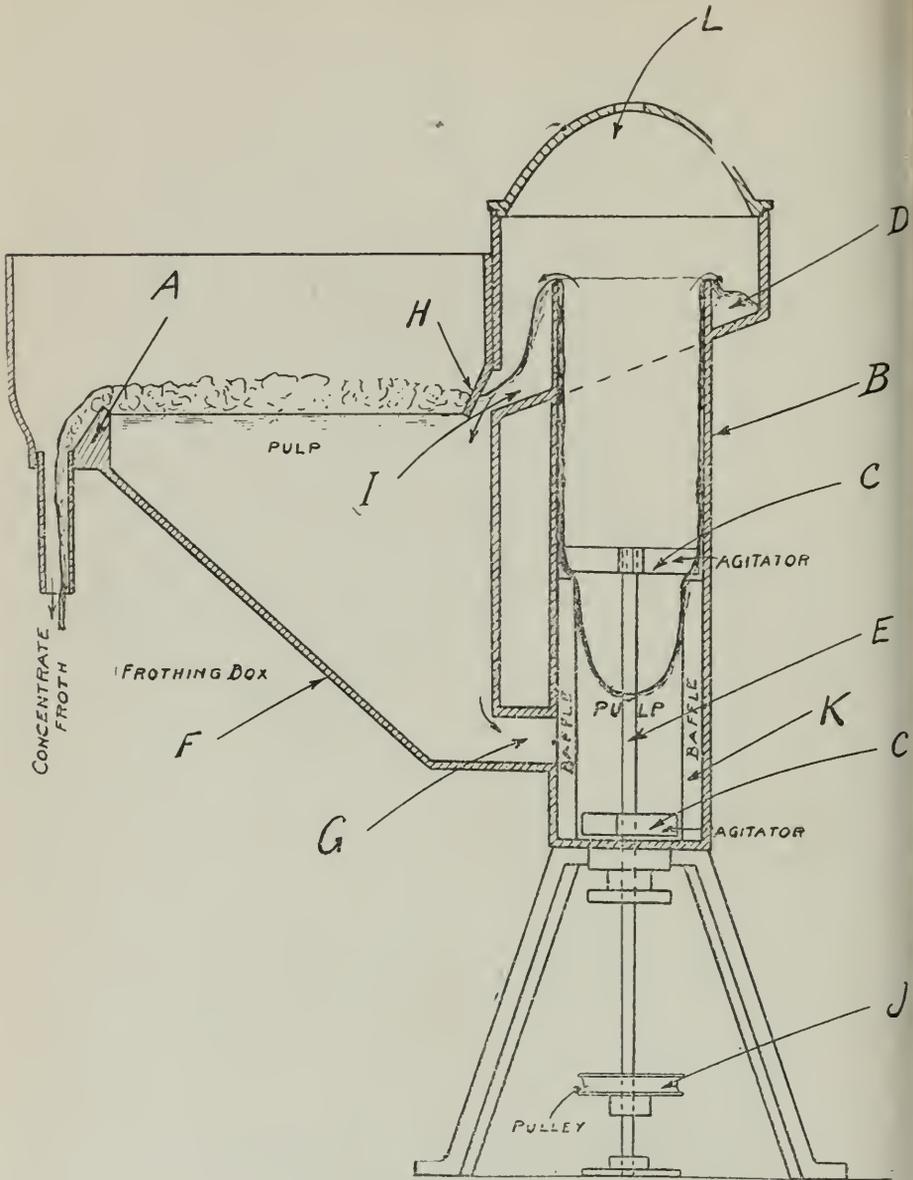
Lantern Slides—Physical Exhibit.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 182.

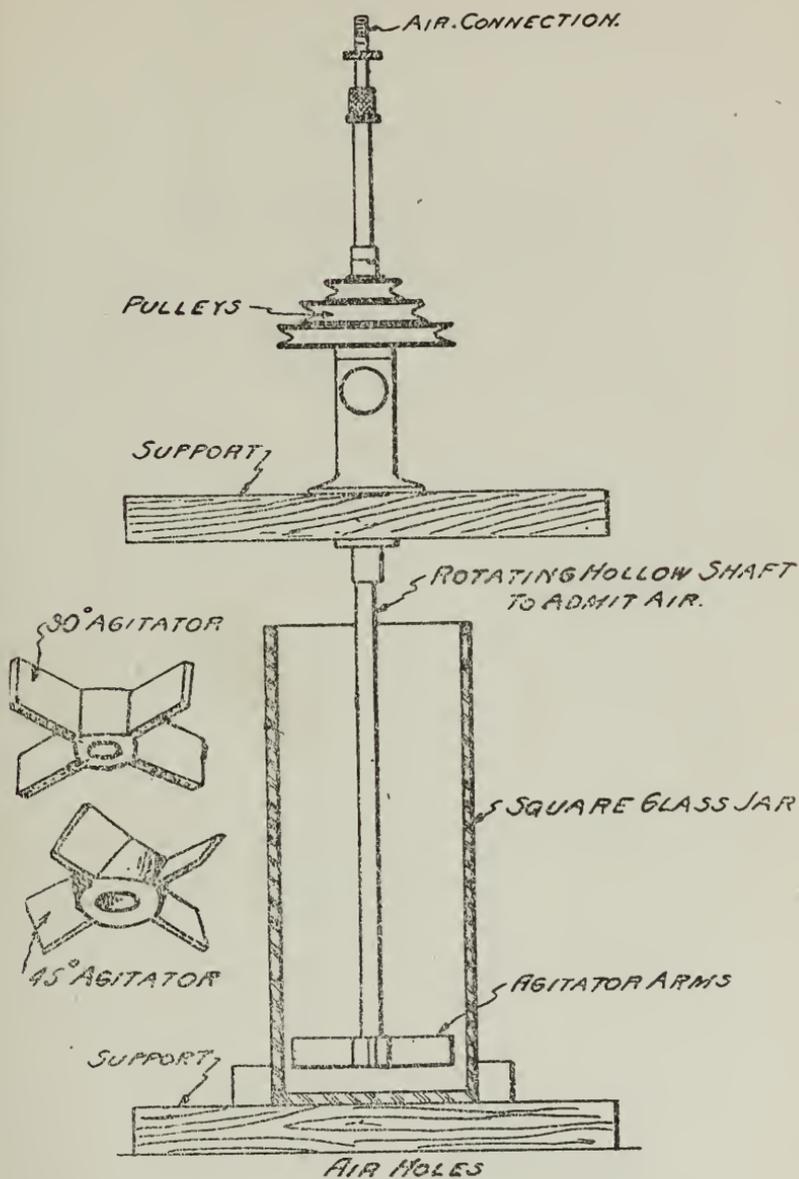


Defendant's Exhibit No. 183.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 184.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 185.

Janney machine—Physical Exhibit.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 186.

Cataract machine—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 187.

Fryer Hill machine—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 188.

Square Glass Jar machine—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 189.

Cone Gabbett including upcast—Physical Exhibit.

Filed August 9, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

JAN 1, 1916

METALLURGICAL AND CHEMICAL ENGINEERING

Ore Flotation*

BY WILDER D. BANCROFT

When discussing the theory of ore flotation, people are apt to lay great stress upon surface tension in general and upon contact angles in particular. While this is entirely legitimate, it seems undesirable, because we cannot measure a contact angle with any accuracy and hence the actual existence of a contact angle is a matter of doubt.¹ The problem of ore flotation is a simple one or a very complex one, depending on our point of view. It has been customary to consider it as a very difficult problem, but the other attitude rather appeals to me. There is nothing strange to us in the fact that water wets glass and that mercury does not. We also know that water does not wet greasy glass easily. If one wishes to say that these facts are mysterious, I concede it willingly, because everything bears mysterious if one follows it back far enough. All that is mysterious is that this is no more mysterious than anything else and that if we start with these bits of every-day knowledge as given, there are no other serious difficulties in connection with ore flotation. Ore flotation is a unique phenomenon, it is merely a special case of the broad heading of emulsions.

When a liquid wets a solid, it is adsorbed by the solid, forming a liquid film on the surface of the latter and displacing the air film that was there. If a liquid is adsorbed by the solid, it does not wet the solid. The formation of a liquid film over the surface of a solid accounts for the experimental fact that the rise of a liquid in a capillary tube is independent of the nature of the walls of the tube. This has always seemed a very improbable state of things, and one that could be justified only by the fact that it was so. It becomes quite simple, however, the moment we consider the rising liquid does not come in contact with the walls of the capillary tube at all. We are really dealing with the rise of liquid in a liquid tube, and it makes no difference what material is used to support the walls of the liquid tube. That this is the real explanation may be seen from the fact that concordant results are not obtained when a liquid is allowed to rise in a dry tube. To get good results it is important to immerse the tube in the liquid and then to raise the tube.

The wetting of a solid is a case of selective adsorption, we should expect that one liquid would wet a given solid more readily than another liquid does, and consequently that the first liquid would displace the second from contact with the solid. No systematic study of this phenomenon seems to have been made, but we know that alcohol will displace oil in contact with metal² and that water will displace kerosene in contact with paraffin.³ If we shake a finely divided solid with water and a liquid which is not completely miscible with water, we can distinguish three cases. The solid is wetted entirely by water, in which case it stays in the water phase and settles to the bottom of it. The solid is wetted entirely by the oil, in which case it stays in the oil phase and sinks to the bottom of it. The solid is wetted simultaneously by oil and water, in which case it passes into the interface separating the two liquids. If the oil is less dense than the water, as is usually the case, it is a little difficult to distinguish between the last two cases. If the non-aqueous liquid is denser than water, chloroform or carbon tetrachloride for instance, it is difficult to distinguish between the

first and third cases. The particles will float if the mean density of solid plus adherent oil film is less than that of the water. They may also float if the action of gravity is not sufficient to overcome the surface tension of the water and thus to pull them through the surface. The maximum weight of substances which can be floated can be calculated from the surface tension under ideal conditions. This calculation applies only when the solid passes into the upper liquid, and does not hold for the case where the solid passes into the interface.

Since we are dealing with selective adsorption, we should expect to find that certain substances would float readily, some others less well, and still others not at all, both the nature of the solid and of the liquid having an effect. This is the case experimentally. Hofmann⁴ found that lead iodide, silver iodide, mercuric iodide, mercuric sulphide, and mercuric oxide were floated by ether, butyl alcohol, benzene, kerosene, and amyl alcohol. Copper sulphide, lead sulphide and calcium carbonate were floated only partially by ether, but completely by the other liquids; while zinc sulphide and tin sulphide did not float readily in ether or butyl alcohol, and calcium sulphate was not floated by any of the liquids.

An interesting experiment, which has been done in my laboratory,⁵ is to shake copper powder or aluminium powder with kerosene and water. The metallic powder goes into the kerosene and into the interface, producing an effect of molten copper or molten aluminium, as the case may be. When the bottle is allowed to stand after having been shaken, the metallic powder in the interface creeps up the side of the bottle above the surface of the liquid, rising higher if a little alcohol has been added. I have seen an apparently coherent metallic film rise 2 or 3 in. above the surface of the upper liquid phase. If too much copper or aluminium be added, the kerosene cannot hold all of it up and a portion falls to the bottom of the flask, carrying crops of kerosene with it. If the mixture be poured out on a piece of wood, the copper spreads over the surface of the wood just as it did over the surface of the glass. This experiment illustrates the principle involved in all bronzing liquids. A bronzing liquid consists of a volatile liquid which will hold up the metal, and some substance which will keep the metallic powder from rubbing off too readily after it has been applied. The aluminium and copper powders on the market are coated with stearin. This makes them difficult to wet with water, but special experiments have shown that the behavior of copper or aluminium with kerosene is qualitatively the same whether the stearin coating is removed with ether or not.

Similar results can be obtained with colloidal solutions. Isobutyl alcohol⁶ was added to a colloidal gold solution obtained by reducing gold chloride with carbon monoxide. When the two liquids are shaken, the gold forms a thin film at the interface. This film is violet blue to blue green by transmitted light and golden by reflected light. A thin water film forms between the isobutyl alcohol and the glass, and the gold concentrates in the dimeric interface thus formed, making the alcohol appear uniformly gold-plated. With ether the gold film rises high above the level of the two liquids. With carbon bisulphide the adherent film of gold appears blue. When the carbon bisulphide is broken into drops by shaking, each drop appears blue. When a blue gold was obtained by reducing gold chloride with phosphorus dissolved in ether, the gold went into the dimeric interface. When a brownish-red gold was obtained in this way, it remained in the water phase and showed no tendency to pass into the interface. This difference is undoubtedly due to an adsorption of some-

*A paper read at the Joint meeting of the New York sections of the American Institute of Mining Engineers and the American Electrochemical Society on May 12, 1916.

¹Taylor, Scientific Papers, 2, 254 (1902).

²Duckles, Wied. Ann. 67, 669 (1899).

³Hofmann, Zeit. Phys. Chem. 31, 285 (1900).

⁴Bancroft, Trans. Am. Electrochem. Soc. 33, 204 (1912).

thing at the surface of the gold, because Reinders found that 0.005 per cent gum arabic prevents colloidal gold from passing into the ether water interface. With carbon tetrachloride, carbon bisulphide, or benzene, the gold goes into the interface as before, but the gum arabic prevents its changing from red to blue.

Colloidal arsenic sulphide goes into the dineric interface with amyl alcohol or isobutyl alcohol, but stays in the water phase when carbon tetrachloride, benzene or ether is the second liquid. India ink goes completely into the interface with amyl alcohol, carbon tetrachloride, or benzene; it goes partly into the interface with isobutyl alcohol, and stays entirely in the water phase when ether is the second liquid.

Winkelblech¹ has shown that mere traces of gelatine in water can be detected by shaking with organic liquids, the gelatine concentrating at the interface to form a film. "A heavy precipitate was obtained when 10 c.c. of a solution containing 0.234 g. gelatine per liter was shaken with benzene. Precipitates were also obtained when the gelatine solution was diluted tenfold, twentyfold and even fortyfold, provided 10 c.c. solution were taken for the test. At the highest dilution the concentration of the gelatine was 0.06 g. per liter, and there were consequently 0.06 mg. in the 10 c.c. taken for the test. This seemed to be about the limit at which a precipitation could be detected definitely. . . . Some other colloids behave like the glue colloid (glutin), and can be shaken out of their solutions. Other hydrocarbons are also effective, so that the phenomenon seems to be a general one. Precipitation was obtained with albumin, water-soluble starch and soap, as well as with resin dissolved in very dilute caustic soda. The colloids grouped as mucin can be precipitated from urine and the proteins from beer. It is worth noting that tannin can be precipitated but not gallic acid.

"The hydrocarbons which can be used are: kerosene, liquid paraffin, benzene, chloroform, and carbon bisulphide [in addition to benzene]. The result varies from case to case. With the hydrocarbons which are lighter than water, the precipitate floats on the water; with the denser hydrocarbon the precipitate is below the water layer. The emulsions which form seem to have very nearly the same density as the organic liquid used. It is not possible to get the precipitation with all liquids which are non-miscible or slightly miscible with water. Experiments with ether were entirely unsuccessful.

"As a complement to the action of hydrocarbons on aqueous colloidal solutions it was found that fats dissolved in hydrocarbons or similar liquids can be precipitated in the surface film by shaking with water. Precipitations were obtained with butter, olive oil, lanolin, and vaseline. It was also found that the emulsions of heavy hydrocarbons or carbon bisulphide with the fats of low specific gravity also accumulate below the water layer, only a small portion being carried to the surface by adhering air bubbles. When water is used for shaking out, the precipitation is very slight. With a slightly alkaline solution such as dilute lime water, heavy voluminous precipitates were obtained while a transparent layer of fat is obtained when a slightly acid solution is used. With concentrated alkali or acid solutions, viscous emulsions are obtained which hold fast considerable amounts of solution."

Winkelblech patented the use of such organic liquids as kerosene for clearing sewage by shaking out the colloidal oxidizable matter. The method was not a success commercially, because less than 40 per cent of the oxidizable matter was removed.²

Briggs³ has shown that sodium oleate is removed from

solutions of different strengths during the process of emulsifying benzene, and that the amount of this removal depends upon the strength of the soap solution and the specific surface of the benzene phase. Rayl⁴ has observed an interesting case in which dust goes to the water layer. "In the course of some experiments last year, in illustration of Sir George Stokes' theory of ternary mixtures, I had prepared an association of water, alcohol, and ether, in which the quantity of alcohol was so adjusted that the tendency to divide into parts was almost lost. As it was, division took place after shaking into two nearly equal parts, and the parts were of almost identical composition. On pouring the bottle containing the liquids in the concentrated light from an arc lamp, I was struck with the contrast between the appearance of the two parts. The more aqueous layer was charged with motes, while the upper, more ethereal, layer was almost perfectly free from them. Some years ago I had attempted the emulsification of motes by repeated distillation of liquid under vacuum, conducted without actual ebullition, but I never witnessed as the result of this process anything so clear as the ethereal mixture above described.

"The observation with the ternary association, which happened to be the first examined, is interesting, because the approximate equality of the liquids suggests that the explanation has nothing directly to do with gravitation. But the presence of the alcohol is necessary. Ether and water alone shaken together do not exhibit the same phenomenon. It would appear that when the two liquids are mixed together in a finely divided condition, the motes attach themselves by preference to the more aqueous one and thus when separation into two distinct layers follows, the motes are all to be found below."

"I have lately endeavored to obtain some confirmation of the views above expressed by the use of other liquids. It would evidently be satisfactory to exhibit the action of motes by the upper, instead of by the lower, layer. Experiments with bisulphide of carbon and water, and also associations of these two bodies with alcohol, which acts as a solvent to both, gave no definite results, perhaps in consequence of a tendency to the formation of a solid pellicle at the common surfaces. But with chloroform and water, and with associations of chloroform water and acetic acid (acting as a common solvent) the experiment succeeded. The motes were always collected in the upper, more aqueous, layer, even when the composition of the two layers into which the liquid separated was so nearly the same that a few additional drops of acetic acid sufficed to prevent separation altogether."

The reverse case appears to occur with white lead. Cruickshank Smith⁵ says: "During recent years this practice has been adopted, largely among white-lead producers who grind their own white lead in oil, of doing away with the final drying of the white lead pulp as it comes from the washing process, and grinding or bringing up the pulp (exhausted of water until the proportion of the latter does not exceed about 20 per cent) with a suitable quantity of refined linseed oil. This procedure depends on the greater surface attraction which white lead particles offer to linseed oil than to water. It enables considerable economies to be effected in the manufacture of ground white lead, and it eliminates the risk of lead poisoning during one of the most dangerous parts of the white lead manufacturing process."

¹Scientific Papers, 3, 569 (1902).

²Association is here employed as a general term denoting the juxtaposition of two or more fluids. Whether the result is a mixture depends upon circumstances.

³The clearness of the upper layer, after a mixture of ether and alcohol has been shaken up with dust, had already been observed and explained, much as above, by Barus, Amer. Jour. Sci. (3) 112 (1889).

⁴The Manufacture of Paint, 92 (1915).

⁵Zelt. angew. Chem. 19, 1953 (1906).

⁶Blitz und Kinetik, Zelt. angew. Chem. 20, 883 (1907).

⁷Ann. Chem. 19, 210 (1915).

is added to float the white lead and consequently the white lead carries the oil down with it," water as upper phase.

The adhesion between the solid and the liquid is very marked is shown by the behavior of the water wings. These consist of a closely woven fabric which is really permeable to air when dry. When thoroughly wet, the film of water is strong enough to support the wings being blown up enough to float a person on his ease—Though I know of no direct experiments on the subject, it seems probable that the gas adsorbed on some sandstone anticlines may result from the air being displaced by water, which would wet the rocks more readily than does the oil.

In many of the cases where oil flotation has been employed we have a sulphide ore, which is much more readily wetted by oil than by water, in presence of a gangue, which is much more readily wetted by water than by oil. Consequently the gangue tends to be in the water phase while the ore is carried up by oil. The use of an acid solution is natural, because of the hydroxyl ions," and these latter cut down the adsorption of the solid. Nagel¹ found that when precipitated chromic oxide is shaken with water and the precipitate goes into the dimeric interface, but is precipitated from it by addition of caustic alkali. Zinc hydroxide is also precipitated from the dimeric interface with water by addition of alkali. I am aware that modern flotation practice is tending to the use of slightly alkaline solutions, but in such cases play an important part, and the use of mixed oils introduce a new set of factors. It must also be noted that acid in ore flotation does not act as a replaceable hydrogen atom, but by cutting down the concentration and consequently the adsorption of hydroxyl ions. If calcium ions, for instance, cut down the adsorption of hydroxyl ions sufficiently, calcium hydroxide would behave like an acid, so far as ore flotation is concerned, though it would be alkaline to the water. Somewhat similar cases are known. In electrical stress albumin moves to the cathode in alkaline solutions, and also in calcium chloride solutions. In acid solutions it is not a question of acidity. The direction in which the albumin moves depends upon the charge of the adsorbed ion in excess. The hydrogen cation and ammonium cation are each adsorbed more than the hydroxyl anion, and consequently the albumin moves to the cathode in these two solutions. I do not know of anything of this sort is a factor in modern flotation practice.

No systematic experiments have been made to determine the exact effect of temperature, we do not know to what extent the apparent advantages of a heated solution are due to a relative change in the selective adsorption, to a change in the relative densities of the solids, or to a change in the viscosities. It seems probable that all three changes are factors, but that the change in the selective adsorption is the important one. The absolute adsorption must decrease with increasing temperature, but the selective adsorption may probably does, increase with rising temperature. At higher temperatures the decrease in absolute adsorption becomes too serious and there is therefore a maximum temperature which is not necessarily the same under varying conditions.

We now have to consider the part played by air in flotation. Since the density of air is low, it is clear that the adsorption of adsorbed air or an attached bubble of air will be effective in floating a solid particle. If we like,

we may consider air as an extreme case of a second liquid phase, in which case we may have the solid remaining in the air phase under suitable conditions, concentrating in the interface, or remaining in the water phase. If a piece of metal covered with an air film be laid very carefully on the surface of water, the water may wet it so slowly that the metal will float if it is not too heavy. If the surface of a copper wire be converted to sulphide, it will float more readily because the adsorption of air is more marked. If we have a stearin surface, as in the case of copper powder or aluminium powder, the water has still less tendency to wet the solid, and it becomes quite difficult to cause the commercial copper powder or aluminium powder to sink in water. This difference in readiness to wet is made use of in the film flotation processes of Wood and McQuisten.

The concentration of the solid at the interface occurs when a skin forms over the surface of boiled milk or of cocoa or of a peptone solution. I do not know of any case of ore flotation analogous to this, but doubtless one could be devised if anybody was interested in it. In the case of soap solutions we have a partial concentration in the surface, but the bulk of the soap remains distributed through the water phase. The soap, however, adsorbs so much air that boiling-point determinations on concentrated solutions are worthless.

The selective adsorption of gases and vapors by solids is a matter of common knowledge." The film of condensed gas shows itself in the abnormal mobility of very fine powders, in the fact that two pieces of a broken object will not reunite when pressed together, in a resistance to the passage of an electric spark between solid terminals, and in the behavior of the crystal detector and the coherer as used in wireless telegraphy. All liquids show selective adsorption of gases and vapors. The most striking way in which this shows itself is in the form of the splashes when a drop of water, 5 mm. in diameter, falls on a sheet of water from a height of less than 1 meter. It is this film of adsorbed gas which tends to prevent the coalescence of two soap-bubbles or two impinging jets of water when there is no electrical stress.

Since water removes air more or less quickly from practically all minerals, selective flotation from already wetted ore is practically impossible, and one must have recourse to the combined effect of oil and air. It so happens that in acid or neutral solutions air seems to be adsorbed by organic liquids much more readily than by water." Into 100 c.c. approximately normal caustic potash solution 0.5 c.c. chloroform was dropped from a 5 c.c. pipette. The chloroform did not seem to spread out on the surface before sinking so much as it did with water. The globules sank to the bottom and flattened out; they were distinctly not very mobile, and seemed to sink to the bottom of the vessel. When the chloroform was dropped into the water it broke up into a number of drops which did not agglomerate so easily as in the water solution. In fact, quite a little shaking was necessary in order to make them coalesce. At first no air bubbles could be detected, but after standing for five minutes a very small bubble appeared on the chloroform. Sulphuric acid was then added until the solution became acid. The flattened drop of chloroform at once assumed the shape of a round ball and became mobile. An air bubble also appeared in the center of the drop.

"Into 100 c.c. approximately normal sulphuric acid solution 0.5 c.c. chloroform was dropped as before. The chloroform spread all over the surface and then sank

¹Attention was first called to this by Mr T. R. Briggs, *Trans. Amer. Soc. Chem. Eng.*, 1915, 16, 1915; *Jour. Phys. Chem.*, 19, 360 (1915); *Phys. Chem.*, 19, 570 (1915).

²McBain and Taylor, *Zett. phys. Chem.*, 76, 183 (1911)

³Francrot, *Jour. Phys. Chem.*, 20, 1 (1916)

⁴Twomey, *Jour. Phys. Chem.*, 19, 350 (1915)

through the solution in small drops, forming round globules with air bubbles clinging to each. It was hard to get rid of the bubbles on the chloroform drops by shaking; as soon as one was driven off another bubble appeared exactly in the center of the drop. When the bubbles were dislodged from the drops, they rose to the surface carrying with them some chloroform, a part of which remained on the surface until it evaporated, while the rest sank back to the bottom of the solution. The globules were very mobile and coalesced readily. Causit potassium was added to the solution, making it alkaline. The chloroform globule flattened immediately and the air bubble in the center disappeared. In still another experiment an acid solution was made alkaline, then acid, and then alkaline again. The result confirmed Wilson's experiments," for the drop of chloroform was always flat in the alkaline solution and always found in the acid solution. There is scarcely any difference to be noted between the shape of the drop in acid solution and in pure water. The same results were obtained when NaOH and HCl were substituted for KOH and H₂SO₄.

"In one experiment in a nitric acid solution the temperature was raised to about 40 deg. C. Bubbles seemed to shoot from all parts of the solution to the chloroform drop. When they had formed a large bubble in the center of the chloroform, the air bubble rose to the surface of the solution as in the other cases."

Of course, it does not follow that the relative adsorption of gas is always greater for oil in acid solution, but merely that this seems to be true in the cases hitherto studied. It is purely an empirical observation. Another interesting fact is the difficulty that is experienced in getting air bubbles to attach themselves in some cases to the oil films surrounding the solid particles. Some people have even claimed that nascent gas is essential, but this is absurd. If the air bubble comes in contact with the oil it will adhere; but it is not easy to bring about this contact. It can be done by vigorous agitation or by causing dissolved gas to come out of solution, but the essential thing is merely to bring the gas in actual contact with the oil.

A large air bubble will have a relatively great lifting power, but it will also tear loose very readily from an oiled particle. We shall get better results if we produce a froth consisting of bubbles of air in oil. Under ideal conditions the film around the bubbles will consist of particles coated with oil. We cannot get a froth with a pure liquid and air. There must be present a third substance in colloidal solution which will tend to form an emulsion of air in the liquid in question, for a froth is essentially a very concentrated emulsion of air in liquid. If the colloidal material is not present in the liquid it must be added. It has often been overlooked that what is needed for ore flotation is a froth of air in oil. People have said to themselves that froth is what is needed and have added saponine and other things with disastrous results. Saponine produces a froth, but it is a froth of air in water and therefore plays havoc with flotation. The things which have proved successful are substances like sodium resinate so called, which produces a froth of air in water in an alkaline solution but one of air in oil in an acid solution, because free rosin forms a colloidal solution in oil but not in water. Mr. Van Arsdale has worded the matter in what seems a different way by saying that the substance added must tend to emulsify water in oil and not oil in water. This is very nearly the same thing, because substances which form colloidal solutions in oil and not in water tend to emulsify water in oil." I

have preferred to consider the oil-air interface a Van Arsdale the oil-water interface, but the two of view lead to the same conclusions in almost all cases.

So far, we have been considering the case where we have a fair amount of oil. If we cut the amount of oil down almost to a vanishing quantity another comes in, namely, air flotation. When sufficient quantities of oil are used, the air floats the oil and floats the ore. The ore is inclosed in a drop of oil, the properties of matter in mass and sinks to the bottom of the drop of oil, distorting it to a greater or lesser extent. If the amount of oil is decreased sufficiently, we no longer have an oil drop surrounding a particle of ore, but an oiled particle, the lower part of which is in contact with water, the upper part is in contact with air. We are then getting air effect in addition to the oil effect. I know the relative importance of these two effects has been claimed—and disputed—that the modification of flotation is of much greater value than the other. The Wood and the McQuisten processes there is no doubt but that the separation would be more effective if it were possible to cover the ore particles with a thin film of stearin, leaving the gangue particles uncoated. It is very difficult to wet the stearin-coated compounds copper and aluminium powders, and it is therefore very difficult to make them sink under water. In the other processes of ore flotation using very little oil per ton we get a thin coating on the ore analogous to the stearin coating on the copper or the aluminium. It is possible that the air film may surround the particle completely so that the oil does not come in actual contact with the water. In that case we are back to a straight air flotation of oiled particles. This calls for further study because, if established, it would have a very important bearing on the future development of the subject.

It is under these circumstances that addition of oil causes the ore to cement together and sink. We reason for this will perhaps be seen more easily if we consider the analogy of sand and water. When water is mixed with sand, we get a quicksand over which it is unsafe to walk. With only a little water we get a plastic mass over which it is pleasant to walk and out of which children can make fortresses, etc. When the sand dries out more, air gets in between the grains, and the walking becomes hard, though the sand is by no means dry from a chemical point of view. When the amount of oil round the ore particles is sufficiently small, the air gets in and makes a froth possible. With more oil we get a plastic mass; with still more we get the bulk oil process.

Anderson² classifies flotation oils as "frothing" and "collecting" oils. "There is at times some difficulty in grasping the distinction between frothers and collectors as such, for one oil in itself may, and often does, possess both frothing and collecting properties. The action of a frothing oil is such as to produce froth in water or less amount, dependent on the frothing power of the oil. A collecting oil has a collecting power of sulphides in preponderance over its frothing action; therefore, so to speak, a poor frother; a collector oil may have simply a collecting action and little or no frothing action. As stated in the foregoing, so-called oils combine both the properties of frothing and collecting in variable degrees of each.

"The most successful frothing oils include turpentine, cresylic acid and turpentine and other pyrogenous products from the distillation of wood—namely methyl alcohol." The coal tar phenols and the near

¹Wilson, Jour. Chem. Soc. 1, 174 (1848).

²Bauerfeld, Jour. Phys. Chem. 17, 615 (1913).

³Met. & Chem. Eng. 14, 136 (1916).

⁴Van Arsdale calls them "foamers" and "oilers."

⁵This must be an error. W. D. R.

and almost all of the so-called essential oils there. The essential oil of eucalyptus finds particularly in Australian practice, on account of its low cost and immediate supply. Castor oil, however, has already been made, when mixed with kerosene has found application. The more viscous products of petroleum, including kerosene and creosote, have been successful frothing oils." "The mineral oils and tar oils do not generally float on froth, but have a marked selective affinity for the sulphide minerals. Among the mineral oils the following are noted: asphaltum base, crude oil, gasoline, burning oil, creosol, and kerosene."

It is found that thick oils tend to form viscous, coarse froth concentrates, while thin oils form less viscous froths. The action of coal tar in stiffening a mineral froth is indicative of the former. In general, essential oils give a coherent froth and satisfactory extraction; oils like oleic acid or candle tallow, petroleum, and lubricating and engine oils have a strong tendency to produce heavy, thick froths which will not float. Oleic acid has a well-known tendency to float silicates."

A liquid does not form a froth with air, it is found that no oils can be frothing oils except in so far as they contain suitable colloidal material suspended in them. In some cases this colloidal material is organic, in other cases it is for the organic chemist to determine what the special substance is. Since the frothing of the frothing oils is due to the colloidal nature of the frothing oils, it is a question of cost whether it is more economical to mix a frothing oil with a collecting oil or to use the constituent which makes the former a frothing oil.

We are dealing with selective adsorption, we expect to find that some oils would be better than others for certain purposes.

It is stated that "oils derived from the destruction of wood, such as wood creosotes, pyroxylic acid, and the like, are found to give the best results in galena and zinciferous material; coal-tar oils are better adapted to the successful flotation of sulphide-bearing minerals." There are no independent experiments in which this result could have been predicted. If the frothing is due to selective adsorption, anything which will change the latter will change the degree of flotation as far as the oil-water flotation is concerned. Adding a third liquid which is miscible with the other two, will tend to make the oil and water more nearly alike in composition and therefore more effective. This gives us a possibility of varying the degree of selective adsorption within certain limits and its extent should be determined, even though there are no economic advantages. (Now that we are a little clearer as to the cause of frothing, it becomes possible to study new frothing agents more successfully than ever possible that some of these might have distinct powers of their own.) In some experiments made at Cornell by Mr. Briggs, it has been found that addition of salt made it easier to shake out ferric oxide with benzene. The reason for this is that the salt makes the colloidal solution stable. Any substance which prevents peptization of the water phase or promotes it in the oil phase will tend to increase the flotation. I do not yet know to what extent this is applicable to ore flotation; but Mr. Briggs reports that experiments performed on a 60-product from the Joplin district containing pyrite and galena in a calcareous gangue showed: that potas-

sium bichromate will deaerate galena and permit the flotation of the pyrite; that sodium, potassium, and ferric sulphates promoted the production of clean concentrates; and that ferrous sulphate and cupric sulphate were very harmful to the successful flotation of this particular product, flotation being practically impossible in their presence. Anderson, of course, ventures no opinion as to why these salts act in this way; but it ought not to be difficult to work out a hypothesis if some data were forthcoming. The inadequacy of the present data is made clear by the statement of R. H. Richards that in the case of a certain Tennessee zinc ore the addition of a small amount of copper sulphate was necessary in order to bring about successful flotation. We have not yet made any experiments on the factors affecting the air flotation when the oil is reduced to a minimum, so I will not discuss that point at all.

There seems to be no reason to suppose that ore flotation has yet gone beyond the first stages of its development, and certainly a clear knowledge of the general theory should be a help in promoting the development.

Cornell University.

Newark Industrial Exposition

The Industrial Exposition being held at Newark, May 18 to June 3, in the First Regiment Armory, Jay Street (reached by Central Avenue trolley), is representative of the large manufacturing interests of that city. The exhibits are nicely arranged and include a large variety of industries. Among the industrial concerns having space are the following:

Gamon Water Meter Co., water meters.

Standard Oil Co. of New Jersey, Polarine oils and lubricants.

Newark Wire Cloth Co., wire cloth for industrial purposes and screens up to 300 mesh.

Crocker-Wheeler Co., generators, motors.

Westinghouse Electric Co., generators, motors, meters, Westinghouse Mazda lamps.

Murphy Varnish Co., varnish pigments, oils, small grinding rolls, filter presses, etc.

Celluloid Co., celluloid articles.

Driver-Harris Wire Co., Nichrome heat-resisting metal, Monel metal wire, small-wire drawing machine, demonstrating the drawing of copper wire from 0.016 in. to 0.0063 in.

Newark Leather Machinery Company, and combined exhibits of Newark's leather-companies showing different leathers manufactured.

National Oil & Supply Co., Viscos oils and greases.

Combination Rubber Mfg. Co., hose, packing, etc.

Thomas A. Edison, chemicals, phenol, aniline, etc.

Edison Storage Battery Co., Alkaline storage battery.

General Electric Co., Edison Lamp Works, Mazda lamps, historical exhibit showing development of incandescent lamp.

Anti-Hydro Waterproofing Co., waterproof liquid, waterproof paint, for brick, concrete, etc.

F. W. Horstmann Co., McDowell feed-water heater and purifier.

Bureau of Standards Analyzed Samples.—The Bureau of Standards, Washington, D. C., now has ready for distribution a new sample of its iron D, No. 6-b, replacing No. 6-a, which has been long out of stock. The composition of the new sample is: carbon, 2.39; graphite, 1.79; silicon, 2.69; titanium, 0.077; phosphorus, 0.591; sulphur (gray), 0.046; manganese, 1.54; copper, 0.044; chromium, 0.014; vanadium, 0.025; nickel, 0.026. Until printed certificates can be had a provisional certificate of analysis, without details, will be furnished with each sample issued.

Defendant's Exhibit No. 191.

CHINO COPPER COMPANY

HURLEY PLANT

Data Compiled from Statement (Form 12-C) Showing Results of
Operation of Vanner Concentrate Flotation Plant
Month of November, 1916.

FLOTATION PLANT FEED

DATE— Nov. 1916	Lbs. Oil Per Ton	%	Dry Tons Per 24 Hrs.	Assay %	Computed %	Assay %	%	Assumed FeS ₂ in Conc. and Fe Oxide in Tails		Comp. % Tot Sulph.
								Computed %	FeS ₂	
1.....	8.06	46.43	420	3.60	4.51	17.8	6.7	14.4	18.9	
2.....	7.96	41.58	360	4.03	5.05	13.1	4.7	10.1	15.2	
3.....	12.09	39.31	330	5.87	7.37	13.5	6.3	13.5	20.9	
4.....	10.09	40.46	284	6.83	8.56	11.1	6.7	14.4	23.0	
5.....	6.97	40.42	318	5.00	6.26	11.5	6.1	13.1	19.4	
6.....	9.23	37.40	310	4.60	5.76	15.3	6.7	14.4	20.2	
7.....	10.04	36.71	282	5.43	6.81	12.8	6.9	14.8	21.6	
8.....	11.53	34.58	235	7.53	9.44	9.2	5.9	12.7	22.1	
9.....	10.06	37.31	248	6.03	7.56	12.3	5.2	11.2	18.8	
10.....	8.97	36.12	291	7.40	9.27	12.1	5.8	12.5	21.8	
11.....	6.15	37.86	334	8.30	10.40	12.0	5.4	11.6	22.0	
12.....	10.67	39.41	312	8.77	11.00	9.1	4.8	10.3	21.3	
13.....	9.05	40.23	375	8.37	10.45	7.1	3.3	7.1	17.6	
14.....	10.80	41.36	345	8.40	10.55	10.2	4.3	9.2	19.8	
15.....	12.22	38.25	270	8.23	10.35	10.0	6.4	13.8	24.1	
16.....	14.23	41.56	292	9.93	12.45	16.0	6.9	14.8	27.2	
17.....	15.46	41.83	280	10.23	12.85	12.7	5.5	11.8	24.6	
18.....	23.98	30.53	176	9.20	11.40	10.7	4.8	10.3	21.7	
19.....	20.61	32.10	206	12.03	15.10	10.5	5.1	11.0	26.1	
20.....	26.98	26.92	179	9.20	11.40	9.6	6.6	14.2	25.6	
21.....	17.68	36.64	244	9.63	12.05	10.8	7.0	15.0	27.0	
22.....	11.31	43.81	358	8.13	10.20	20.0	7.8	16.8	27.0	
23.....	11.81	40.64	326	5.50	6.91	19.2	8.2	17.6	24.2	
24.....	15.09	34.40	285	6.67	8.38	15.1	9.1	19.5	27.9	
25.....	26.14	28.32	184	7.83	9.85	9.2	8.0	18.2	28.0	
26.....	17.37	32.07	247	7.43	9.32	14.1	9.2	19.5	28.8	
27.....	17.85	33.59	221	8.40	10.55	19.5	16.0	34.3	44.9	
28.....	18.41	29.48	208	10.23	12.85	11.4	10.2	21.8	34.6	
29.....	15.51	36.52	254	10.30	12.90	9.8	6.8	14.6	27.5	
30.....	15.04	35.25	270	10.23	12.85	11.1	7.4	15.9	28.7	

Compiled from
Original Record
April 26, 1917.

(Signed) F. R. WICKS,
Asst. Supt. of Mills.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 192.

RAY CONSOLIDATED COPPER COMPANY

HAYDEN PLANT

Data Compiled from Monthly Statements (Form No. 52-R) Showing
Results of Operation of Vanner Concentrate Retreatment
Plant During Year 1916—Divided Into
10-Day Periods.

Period	Lbs. Oil Per Ton	% Water In Feed	ASSAY PLANT FEED		
			% Copper	% Iron	% Total Cu. & Fe.
1.....	4.21	79.00	5.97	7.04	13.01
2.....	3.22	77.00	5.64	7.14	12.78
3.....	2.93	78.00	6.39	7.15	13.54
4.....	.....	.....	.....	.....	.....
5.....	3.20	74.00	5.01	6.70	11.71
6.....	.....	.....	.....	.....	.....
7.....	2.96	73.00	4.54	6.18	10.72
8.....	3.28	73.00	4.52 ⁶	6.40	10.97
9.....	3.53	76.00	4.88	6.32	11.20
10.....	3.26	77.00	5.20	6.78	11.98
11.....	3.41	76.00	5.40	6.86	12.26
12.....	3.36	75.00	5.12	7.16	12.28
13.....	3.41	79.00	6.06	7.68	13.74
14.....	3.01	73.00	5.42	6.77	12.19
15.....	3.16	75.00	5.26	6.71	11.97
16.....	3.21	76.00	5.15	6.70	11.85
17.....	3.13	75.00	5.60	7.19	12.79
18.....	3.16	78.00	5.96	6.95	12.91
19.....	3.13	77.00	5.37	6.39	11.76
20.....	.....	.....	.....	.....	.....
21.....	3.43	77.00	5.55	6.86	12.41
22.....	2.72	79.00	6.52	8.22	14.74
23.....	3.18	80.00	5.76	6.92	12.68
24.....	3.45	79.00	5.98	7.34	13.32
25.....	2.83	81.00	5.88	6.84	12.72
26.....	3.02	79.00	5.73	6.29	12.02
27.....	3.89	79.00	6.35	6.75	13.10
28.....	4.24	78.00	6.02	6.56	12.58
29.....	3.85	79.00	5.97	6.47	12.44
30.....	4.00	80.00	6.31	7.05	13.36
31.....	2.81	79.00	5.89	6.74	12.63
32.....	2.32	78.00	6.05	6.10	12.15
33.....	2.66	79.00	6.70	6.55	13.25
34.....	3.65	78.00	6.05	6.36	12.41
35.....	3.63	79.00	6.24	6.27	12.51
36.....	.....	.....	.....	.....	.....

Compiled From
Original Periodical
Record

E. W. ENGELMAN,
Flotation Engineer.

April 30, 1917.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 193.**RAY CONSOLIDATED COPPER CO.****HAYDEN PLANT**

Data compiled from monthly statements—(Form No. 62-R)—
showing results of flotation operations for 10-day periods during year
1916. Slime vanner tailing plant.

Periods	Pounds of Oil Per Ton	% of Water in Feed	ASSAY PLANT FEED		
			% Copper	% Iron	% Total Cu & Fe
1.....	1.53	81.0	.867	1.62	2.49
2.....	1.53	81.0	.812	1.63	2.44
3.....	1.82	83.0	.903	1.76	2.66
4.....	.....	.....	.....	.....	.....
5.....	1.25	80.0	.814	1.64	2.45
6.....	1.26	80.0	.818	1.60	2.42
7.....	1.28	80.0	.785	1.54	2.33
8.....	1.48	78.0	.810	1.67	2.48
9.....	1.25	79.0	.896	1.61	2.51
10.....	.73	78.0	.840	1.59	2.43
11.....	.77	75.0	.816	1.73	2.55
12.....	.79	78.0	.726	1.70	2.43
13.....	.79	77.0	.710	1.67	2.38
14.....	.99	76.0	.708	1.61	2.32
15.....	.77	76.0	.680	1.65	2.33
16.....	.96	77.0	.700	1.72	2.42
17.....	.95	76.0	.784	1.60	2.38
18.....	.88	76.0	.770	1.62	2.39
19.....	.77	75.0	.754	1.68	2.43
20.....	.....	.....	.....	.....	.....
21.....	.69	73.0	.719	1.55	2.27
22.....	.69	79.0	.780	1.72	2.50
23.....	.74	78.0	.738	1.52	2.26
24.....	.79	77.0	.713	1.67	2.38
25.....	.84	78.0	.749	1.73	2.48
26.....	.88	79.0	.782	1.71	2.49
27.....	.80	79.0	.805	1.64	2.45
28.....	.85	77.0	.839	1.67	2.51
29.....	.82	78.0	.812	1.71	2.52
30.....	.76	78.0	.700	1.63	2.33
31.....	.66	77.0	.665	1.64	2.31
32.....	.73	77.0	.762	1.57	2.43
33.....	.72	77.0	.753	1.55	2.30
34.....	.66	78.0	.756	1.58	2.37
35.....	.63	78.0	.745	1.62	2.36
36.....	.71	80.0	.783	1.57	2.35

Compiled From Original
Periodical Record.
April 30, 1917.

E. W. ENGELMANN,
Flotation Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 194.

BUTTE & SUPERIOR MINING COMPANY

Data Compiled From Original Records of Flotation Plant Operations,
Month of November, 1916. Flotation Plant Feed.

Date Nov. 1916	Lbs. Oil Per Ton	% Solids	Assay % Zinc	Computed % ZnS
1.....	1.67	22.2	15.0	22.4
2.....	1.50	20.5	13.9	20.7
3.....	1.48	21.7	13.3	19.8
4.....	1.50	21.2	14.6	21.8
5.....	1.55	20.0	13.6	20.3
6.....	1.53	21.7	15.3	22.8
7.....	1.74	17.7	13.8	20.5
8.....	1.75	18.5	14.2	21.1
9.....	1.58	21.7	15.2	22.6
10.....	1.52	21.0	15.1	22.5
11.....	1.50	22.7	12.7	19.0
12.....	1.91	17.7	13.0	19.4
13.....	1.68	19.5	12.4	18.5
14.....	1.28	21.5	12.8	19.1
15.....	1.56	19.5	11.7	17.5
16.....	1.44	21.7	15.4	22.9
17.....	1.16	25.0	13.9	20.7
18.....	1.28	24.5	12.3	18.4
19.....	2.37	16.7	12.0	18.0
20.....	1.23	22.5	12.1	18.0
21.....	1.40	21.7	11.6	17.3
22.....	1.58	22.2	11.2	16.7
23.....	1.44	22.2	11.2	16.7
24.....	1.43	23.2	12.4	18.5
25.....	1.40	22.7	12.5	18.7
26.....	1.69	18.5	11.5	17.2
27.....	1.31	25.0	11.1	16.5
28.....	1.36	22.2	12.0	17.9
29.....	1.54	21.5	12.5	18.6
30.....	1.36	22.7	12.9	19.2

Compiled From Original Record
April 28th, 1917.

J. T. SHIMMIN,
Mill Superintendent.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 195.**UTAH COPPER COMPANY****MAGNA PLANT****METALLURGICAL DEPARTMENT**

Data Compiled From Statement Giving Average Results by Months of
Operation of Vanner Concentrate Flotation Plant.

September, 1914, to December 1st to 24th, Incl., 1916.

DATA PLATTED ON CHART NO. 1.

	Dry Tons Treated	% Solids in Feed	Lbs. New Oil Per Ton of Original Feed
1914			
Sept.	9,258	41.67	3.05
Oct.	10,085	45.46	2.62
Nov.	13,104	50.00	2.11
Dec.	11,776	40.76	2.23
1915			
Jan.	10,171	42.78	3.97
Feb.	12,686	44.20	1.83
March	16,430	42.89	1.23
April	18,350	42.13	1.85
May	20,229	40.42	2.20
June	19,036	32.10	3.84
July	17,613	36.58	4.63
Aug.	17,778	34.72	3.81
Sept.	19,014	39.40	3.85
Oct.	20,792	40.85	3.77
Nov.	21,211	42.08	4.32
Dec.	21,216	40.56	4.71
1916			
Jan.	18,527	37.18	5.11
Feb.	19,000	34.96	4.97
March	20,003	29.20	5.20
April	21,425	28.82	5.37
May	24,142	31.12	4.69
June	28,510	30.66	3.93
July	29,910	29.20	3.90
Aug.	30,333	32.08	3.87
Sept.	30,266	33.34	3.95
Oct.	32,494	33.20	3.75
Nov.	30,375	33.82	3.76
Dec. (1-24)	24,429	33.45	3.83

Compiled From
Original Record
Apr. 30, 1917.

(Signed) R. A. CONRADS,
Metallurgical Engineer.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

UTAH COPPER COMPANY
MAGNA PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Records of Operation of Vanner Concentrate Flotation Plant, for the Year 1916; This Compilation Embraces the Days of the Year on Which the Percentage of Solids in Flotation Feed Was Not Under 31% Nor Over 33%.

DATA PLATTED ON CHART NO. 2.

Date 1916	Per Cent Insol.	Per Cent Solids	Lbs. Oil Per Ton
Jan. 12.....	73.74	32.47	6.12
Jan. 13.....	73.02	32.69	6.06
Jan. 28.....	77.76	32.57	6.34
Feb. 13.....	75.87	31.58	5.00
Feb. 14.....	75.91	31.01	4.57
Feb. 18.....	73.08	32.83	4.89
Feb. 19.....	73.95	31.70	5.35
Feb. 20.....	73.63	32.30	5.34
Feb. 28.....	74.24	31.52	5.27
Mar. 7.....	74.47	32.52	5.03
Mar. 9.....	74.40	31.21	5.39
Mar. 15.....	71.35	31.57	4.71
Mar. 16.....	73.70	31.46	5.40
Mar. 19.....	72.93	31.90	5.68
Apr. 23.....	73.16	31.76	5.63
Apr. 25.....	73.26	32.05	5.41
May 7.....	77.48	32.17	4.66
May 14.....	73.38	32.46	4.11
May 21.....	76.71	31.91	4.57
May 22.....	76.26	32.53	4.45
May 24.....	77.46	31.38	4.97
May 29.....	72.92	31.85	4.54
May 31.....	73.77	32.96	3.79
June 5.....	75.42	32.29	4.08
June 6.....	73.60	32.04	3.95
June 7.....	75.06	31.42	3.57
June 12.....	75.31	31.73	4.16
June 14.....	72.60	31.93	3.95
June 20.....	75.59	31.80	3.83
June 21.....	76.72	31.68	4.12
June 23.....	75.89	32.08	3.45
June 29.....	76.07	31.68	3.82
July 8.....	74.84	31.42	3.70
July 25.....	75.57	31.25	4.20
July 31.....	75.57	31.55	4.20

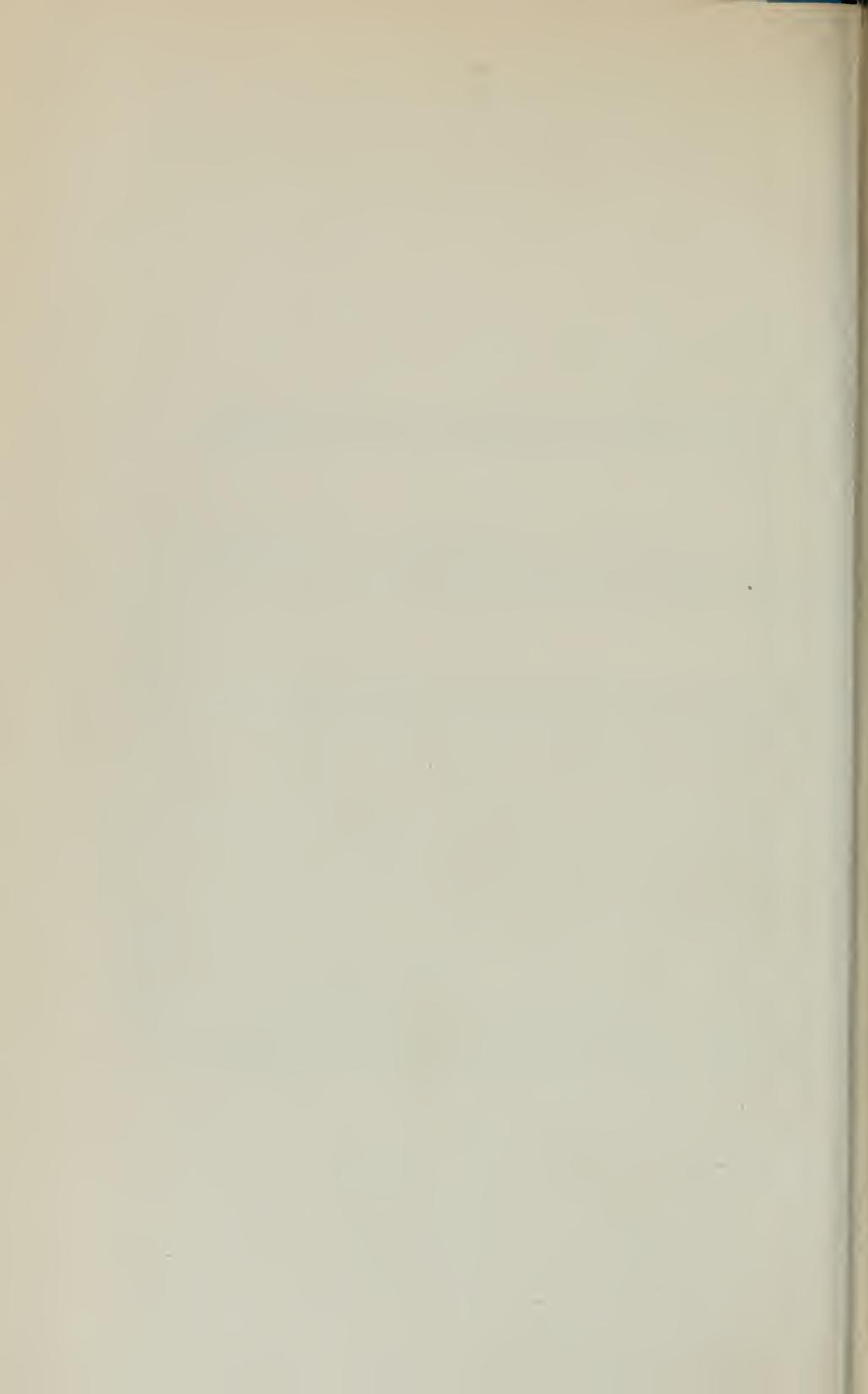
Aug. 9	75.46	31.01	3.76
Aug. 12	75.70	32.49	3.66
Aug. 13	75.44	32.31	3.82
Aug. 14	75.70	31.14	3.67
Aug. 22	74.11	31.53	3.84
Aug. 24	74.53	32.22	3.84
Aug. 25	75.10	31.57	3.88
Aug. 26	74.71	31.99	4.18
Aug. 28	73.81	32.22	4.13
Aug. 31	74.84	32.68	4.05
Sept. 4	72.95	32.28	4.28
Sept. 11	75.86	32.86	3.88
Sept. 12	75.77	31.15	4.23
Sept. 14	75.10	31.95	4.42
Sept. 18	74.80	31.22	4.30
Sept. 20	73.06	32.03	4.03
Sept. 22	74.08	31.96	3.99
Sept. 23	74.60	31.54	4.24
Sept. 24	74.13	31.70	3.99
Sept. 26	75.00	32.30	4.29
Sept. 27	74.40	32.40	3.84
Oct. 7	74.82	31.12	4.14
Oct. 8	74.47	31.36	3.89
Oct. 14	75.10	32.36	3.75
Oct. 16	73.76	32.89	3.67
Oct. 18	72.94	32.41	3.76
Oct. 8	77.51	31.02	4.23
Nov. 11	75.42	32.57	3.67
Nov. 12	75.58	31.99	3.83
Nov. 17	76.25	32.70	3.59
Nov. 18	77.00	32.63	3.64
Nov. 19	75.08	32.83	3.52
Nov. 20	79.08	31.12	5.22
Dec. 7	77.70	32.58	3.58
Dec. 8	77.68	32.35	3.62
Dec. 12	76.36	32.71	4.07
Dec. 15	77.54	31.40	3.74
Dec. 19	75.84	31.96	3.37
Dec. 23	77.76	32.66	3.83

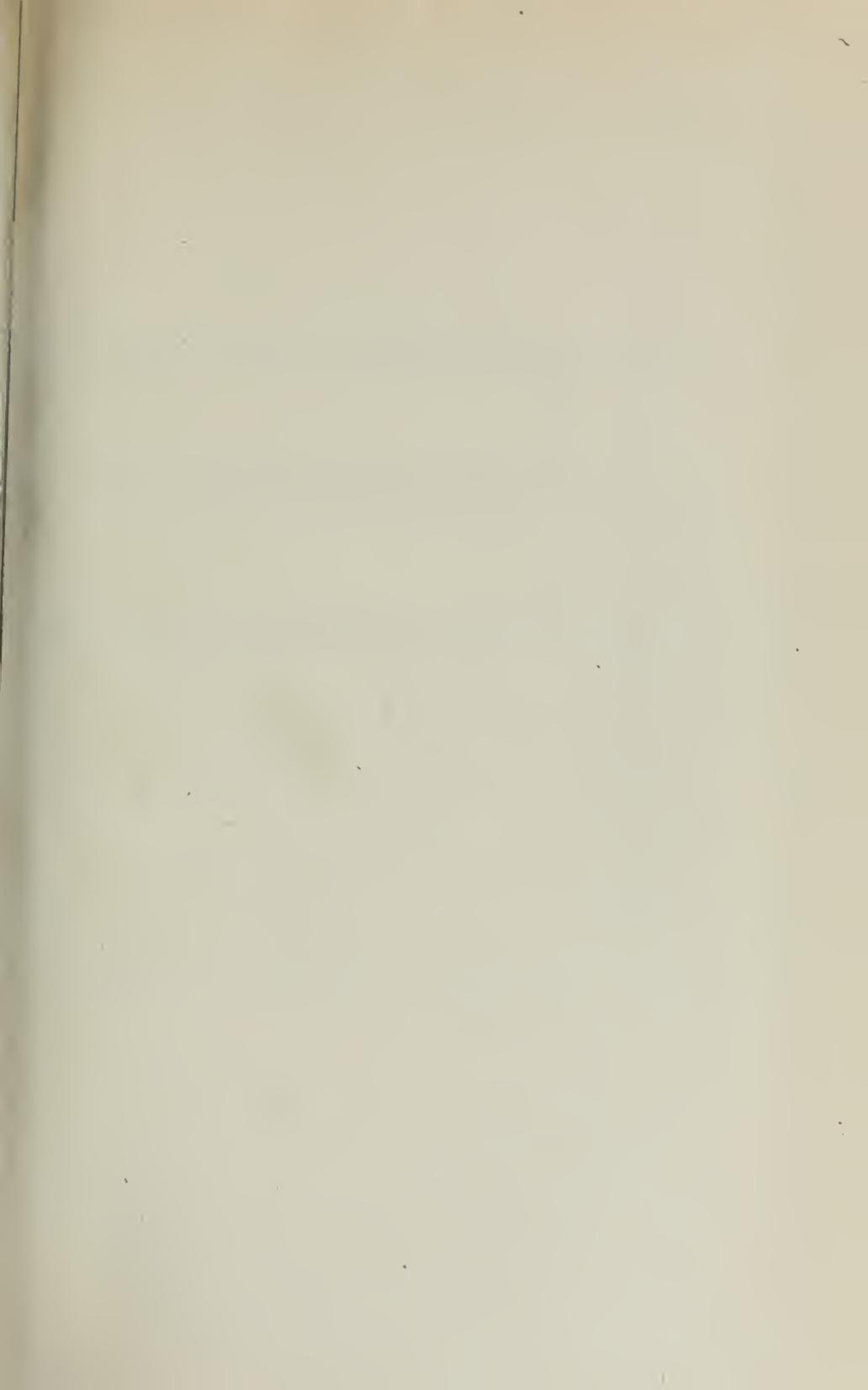
Compiled From
Original Record
Apr. 29, 1917.

(Signed) R. C. CONRADS,
Metallurgical Engineer.

GEO. W. SPROULF, Clerk
By H. H. WALKER, Deputy

Filed May 18, 1917.

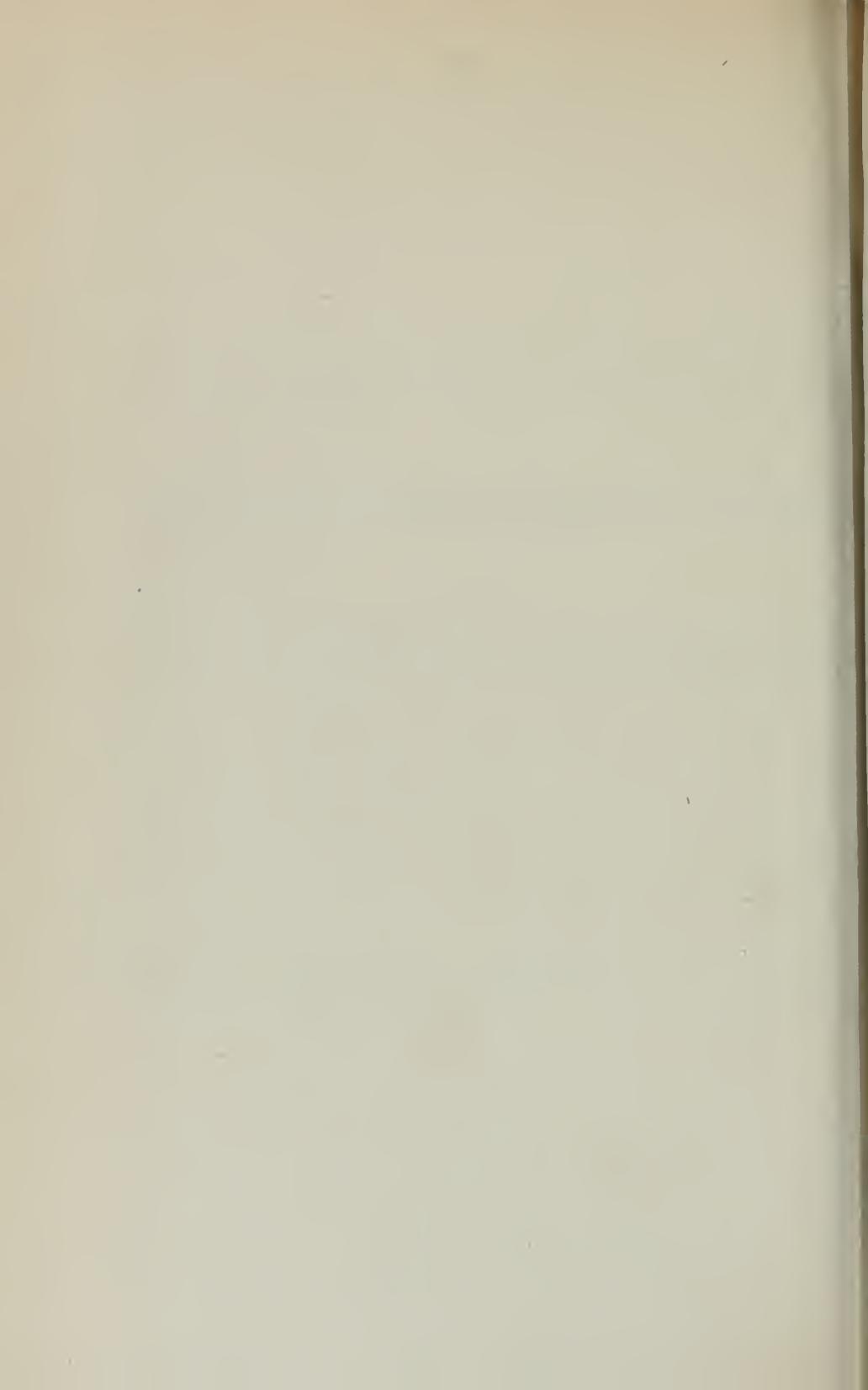




7-29	75.17	29.23	4.15
8-1	74.53	31.02	4.17
8-9	75.46	31.61	3.76
8-10	75.33	29.62	3.94
8-13	75.44	32.31	3.82
8-21	75.47	34.05	3.78
8-23	75.30	35.95	3.90
8-24	74.53	32.22	3.84
8-25	75.10	31.57	3.88
8-26	74.71	31.99	4.18
8-27	74.84	33.27	3.97
8-31	74.84	32.68	4.05
9-1	74.70	35.88	4.29
9-7	75.70	33.34	4.20
9-8	74.65	33.90	3.81
9-14	75.10	31.95	4.42
9-18	74.80	31.22	4.30
9-23	74.60	31.54	4.24
9-25	74.83	30.45	4.57
9-26	75.00	32.30	4.29
9-28	75.20	34.43	3.63
10-3	75.11	33.34	3.78
10-7	74.82	31.12	4.14
10-12	74.85	30.60	4.03
10-14	75.10	32.36	3.75
10-23	75.00	34.16	3.63
10-30	75.43	34.29	3.80
11-6	75.13	35.12	3.81
11-9	74.50	35.30	3.78
11-10	74.76	34.34	3.70
11-11	75.42	32.57	3.67
11-19	75.08	32.83	3.52
11-26	74.80	36.10	3.42
11-30	74.80	37.74	3.39
12-2	75.32	34.40	3.56
12-4	74.89	34.75	3.03
12-6	75.36	33.45	3.67
12-14	75.11	35.54	3.90
12-17	75.33	34.61	3.73
12-18	74.93	36.37	3.72

Compiled From
Original Record
April 29, 1917.

(Signed) R. A. CONRADS,
Metallurgical Engineer.



Defendant's Exhibit No. 198.

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL DEPARTMENT

Data Compiled From Original Record of Operation of Flotation Plant
Treating Original Slime Feed.

The Dates Embraced in This Compilation Are Sept. 1st to Oct. 31st,
1916, Inclusive, Excepting Oct. 8th to 12th Inclusive, on Which
Days a Different Oil Mixture Was Used.

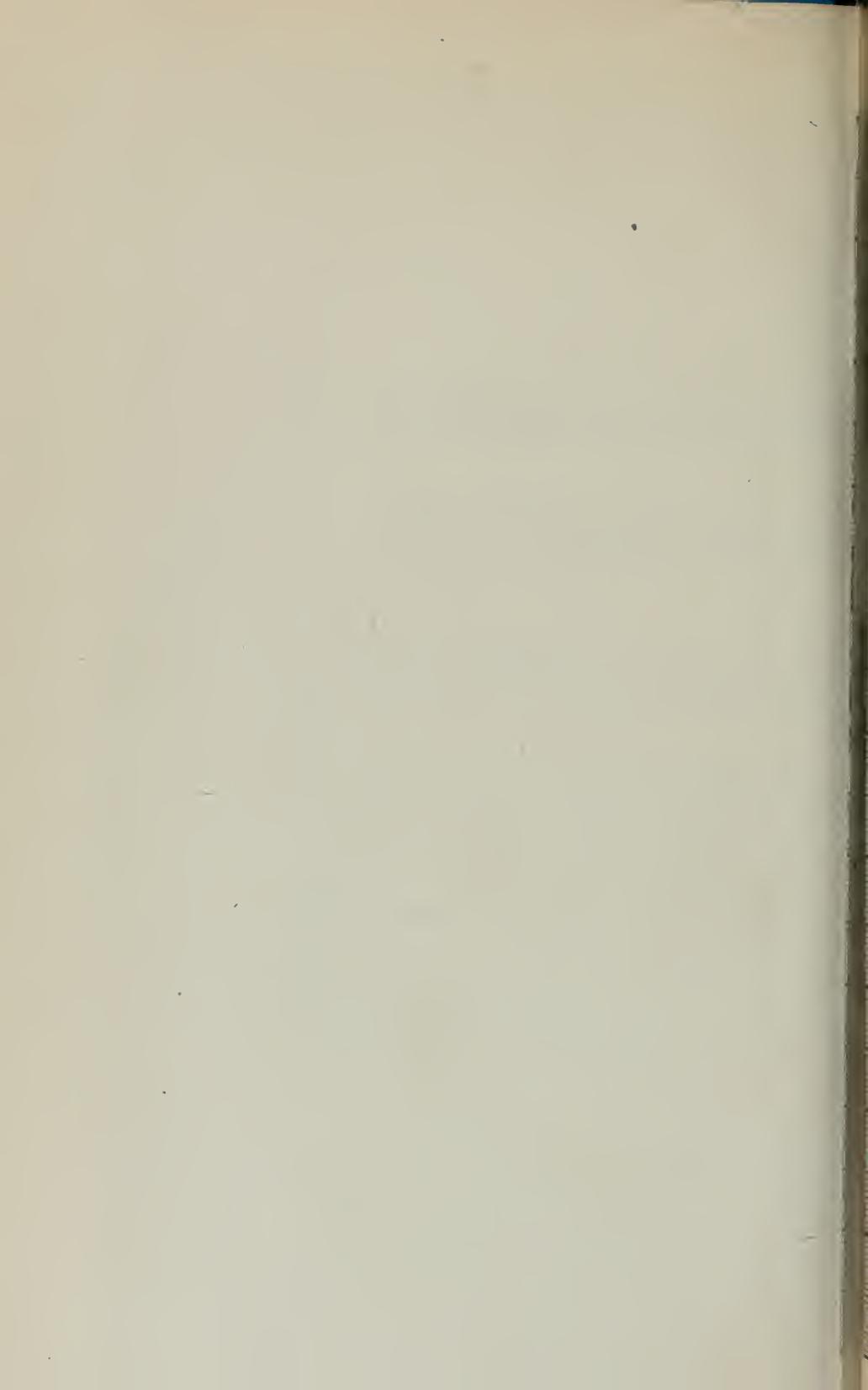
DATA PLATTED ON CHART NO. 1.

Date	HEADING			Lbs. Oil Per Ton	% Solids
	% Cu.	% Fe.			
Sept.					
1	..... 939	1.47		1.26	17.37
2	..... 957	1.35		1.21	18.07
3	..... 1.111	1.12		1.34	17.79
4	..... 1.162	1.20		0.98	20.03
5	..... 1.097	1.80		1.35	17.05
6	..... 1.075	1.50		0.82	19.30
7	..... 1.193	1.30		1.21	19.98
8	..... 1.066	1.35		1.22	16.25
9	..... 1.052	1.33		1.41	16.49
10	..... 1.119	1.35		1.25	17.91
11	..... 1.080	1.73		0.95	18.58
12	..... 1.048	1.65		1.16	17.31
13	..... 1.067	1.05		1.17	21.20
14	..... 1.042	1.47		1.46	17.60
15	..... 1.022	1.60		1.32	16.49
16	..... 1.056	1.33		1.21	17.34
17	..... 873	1.50		1.41	17.74
18	..... 874	1.33		1.35	17.75
19	..... 901	1.60		1.45	17.26
20	..... 1.010	1.57		1.05	18.32
21	..... 1.000	1.85		1.29	17.43
22	..... 1.400	1.51			

Oct.			
1	.....997	1.16	18.39
2	.....1087	1.18	15.53
3	.....1066	1.52	16.74
4	.....1092	1.42	18.94
5	.....1.148	1.35	18.20
6	.....1.035	1.46	16.56
7	.....1.125	1.15	15.90
13	.....992	1.16	18.29
14	.....1.096	1.60	12.34
15	.....968	1.11	2.22
16	.....989	1.25	2.45
17	.....1.010	1.46	1.71
18	.....1.196	1.28	2.02
19	.....1.063	1.21	1.46
20	.....1.066	1.63	17.98
21	.....1.118	1.06	13.13
22	.....1.030	1.30	14.40
23	.....1.061	1.53	16.07
24	.....1.068	1.10	16.55
25	.....1.141	1.38	17.70
26	.....1.363	1.21	1.44
27	.....1.320	1.25	1.41
28	.....1.062	1.62	1.65
29	.....1.150	1.55	16.66
30	.....1.193	1.27	13.83
31	.....1.307	1.88	2.26
			1.81
			1.86
			1.55
			1.42

Compiled From
Original Record.

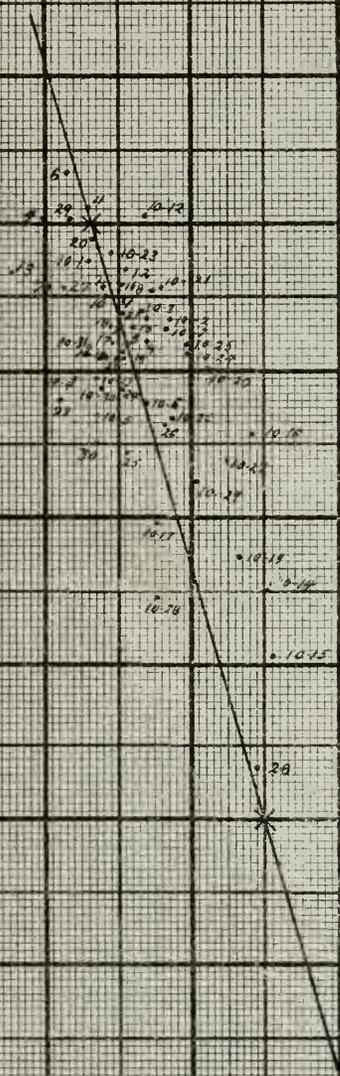
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Percent Water in Feed

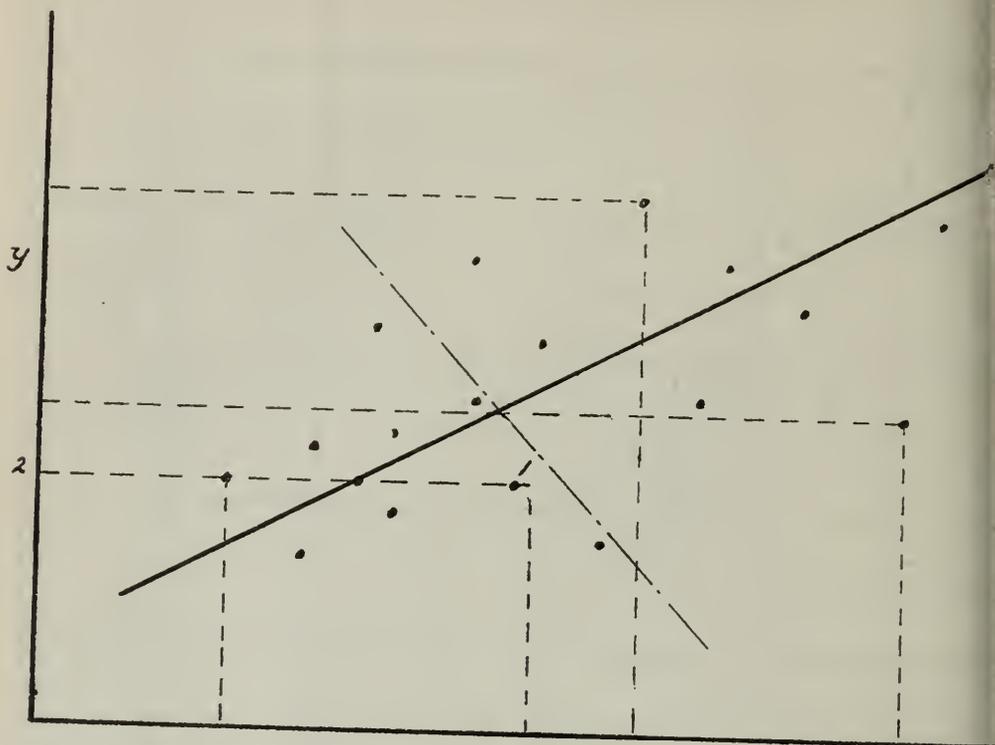
Percent Solids in Feed

88
85
90



Wm. Cappel Co. Arthur Plant Milligan Road Tex. A
 Laboratory treatment of original sludge feed. Months of Sept. & Oct. 1916
 (Comprising Oct. 8-12 incl. when all mixture was changed)
 Data compiled from original records of operation.
 April 30 1917

Chart A-1

DIAGRAM NO. 29 — DEF. EXHIBIT NO. 200 — A.

$$y = Ax + B$$

$$2 = 1A + B$$

$$2.2 = 3A + B$$

$$4.2 = 4A + 2B$$

$$4 = 3.5A + B$$

$$2.5 = 5A + B$$

$$6.5 = 8.5A + 2B$$

$$4.2 = 4A + 2B$$

$$2.3 = 4.5A$$

$$A = \frac{2.3}{4.5}$$

$$B = 1+$$

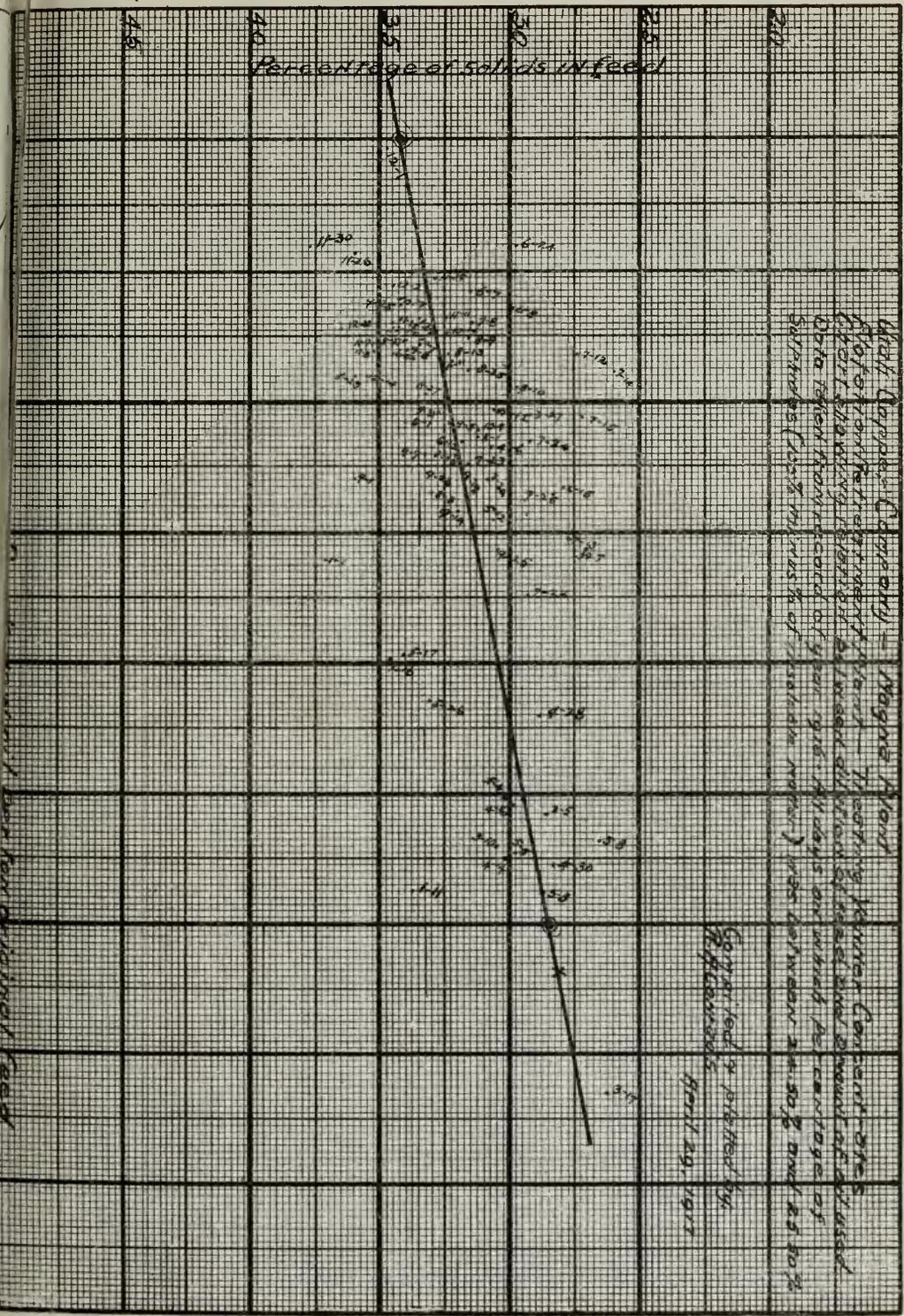
$$y = \frac{2.3}{4.5} x + 1+$$

Percentage of water in feed

65 70 75 80

55 45

Percentage of solids in feed



Walt Dapies (Dapies only) - Wayne Ford
 Plot of water in feed vs. percentage of solids in feed
 Data taken from record of 1 year 1916-1917 days on which per cent of water in feed was between 60-80% and 45-50%
 Solidus (1917) in % of total in water

Graph of feed % plotted by
 W. Dapies
 April 29, 1917

Walt Dapies (Dapies only) - Wayne Ford

1154 HANS BIRTEL, Capital Co., Hayden, Arizona.
 Chart showing relationship between Dilution of Feed and Oil Used
 Data taken from diagonal record of Warner Concentrate Fraction Polymers
 for 10 day periods during year 1916.
 Compiled by E. W. Englemann.

Percent of Dilution of Feed

810
 800
 790
 770
 750
 730

7.14

8

9

10

11

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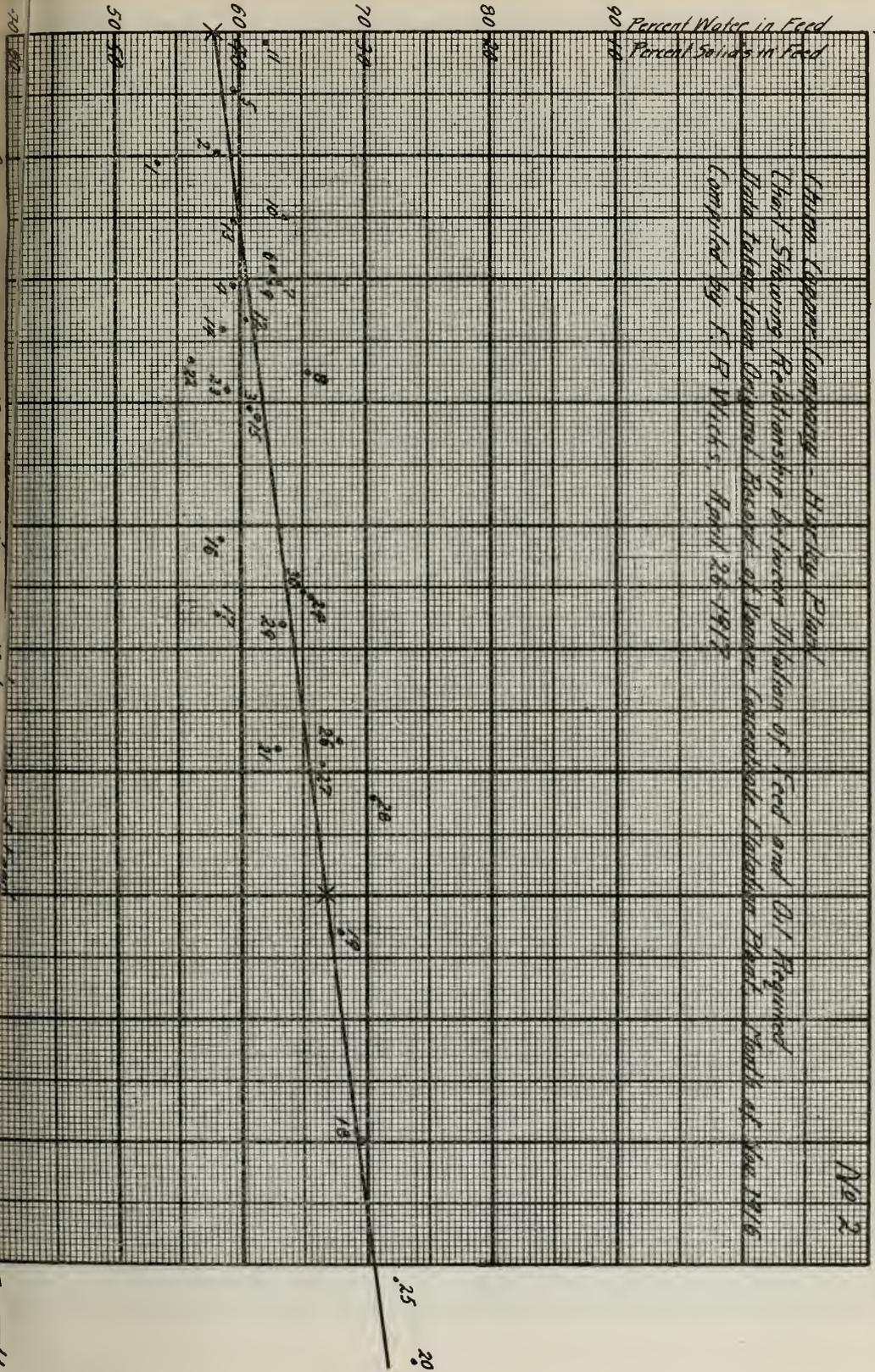
291

292

Percent Water in Feed
Percent Solids in Feed

Thron Lumber Company - Husley Plant
 Short Shaving Relationship between Moisture Relation of Feed and Oil Required
 Italia Tuley Feed Company, Based at Young Lumber Lath Mill, South of New York
 Completed by E. F. Wicks, April 26, 1917

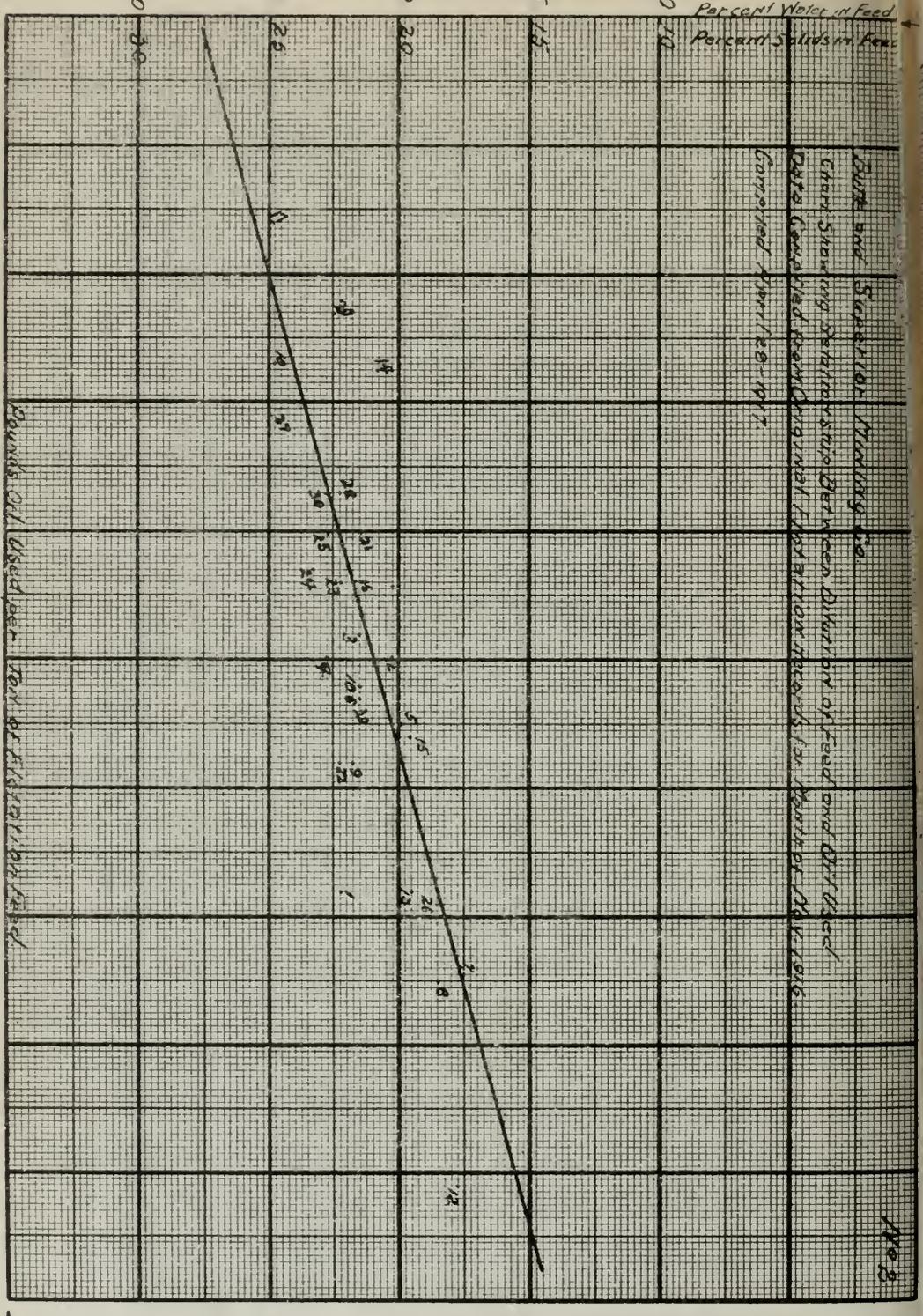
No 2



.25
20

Percent Water in Feed
Percent Solids in Feed

Butte and Superior Mining Co.
Chart Showing Relationship Between Dilution of Feed and Dry Matter
Data Collected from Original Installation Records for Months of Nov. 1916
Corrected Nov. 1917



Pounds of Feed per Ton of Water

1918

Percent of Sulphides in Feed

21 22 23 24 25 26 27 28 29

75 76 77 78 79

Percent of insolubles in feed

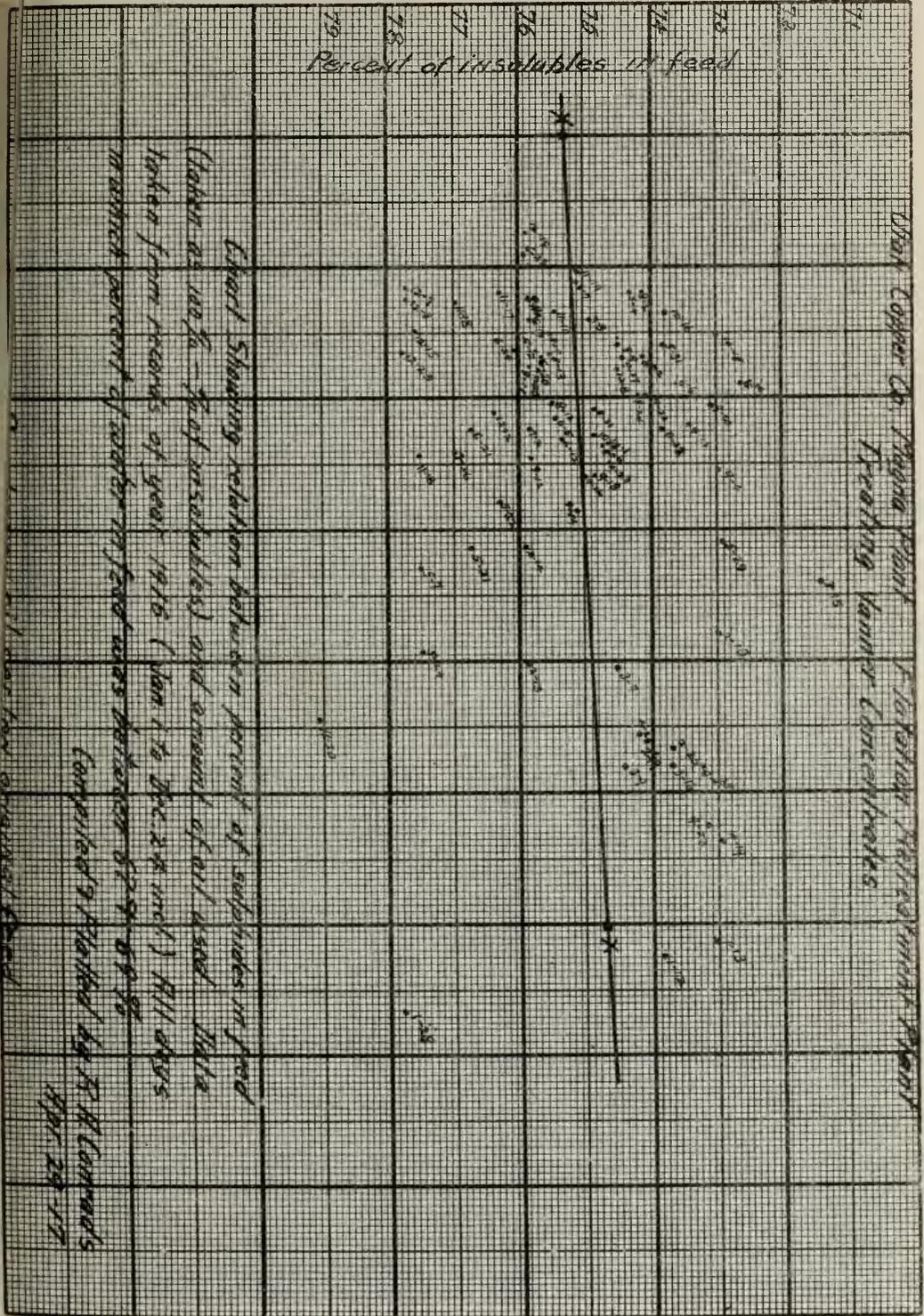
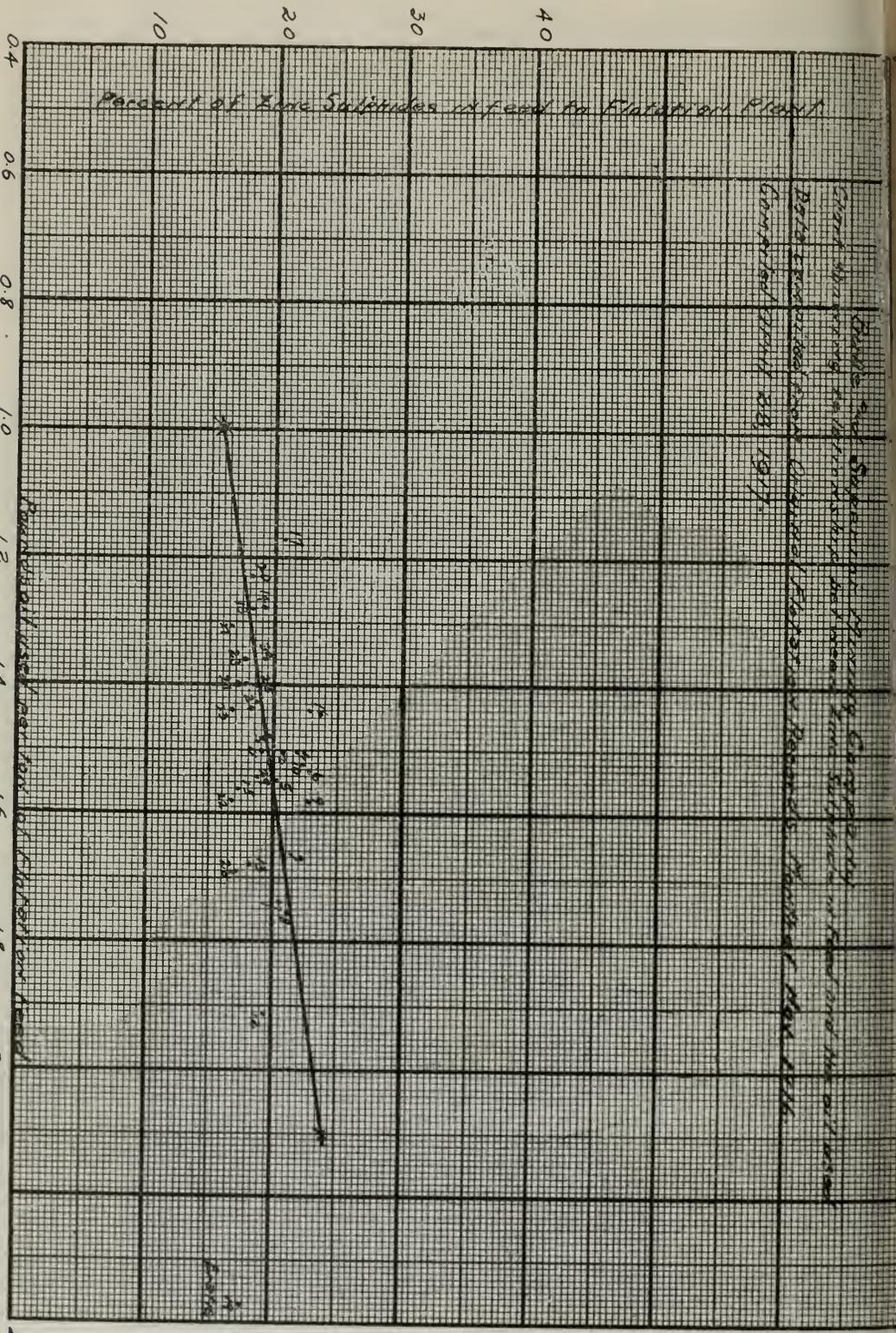


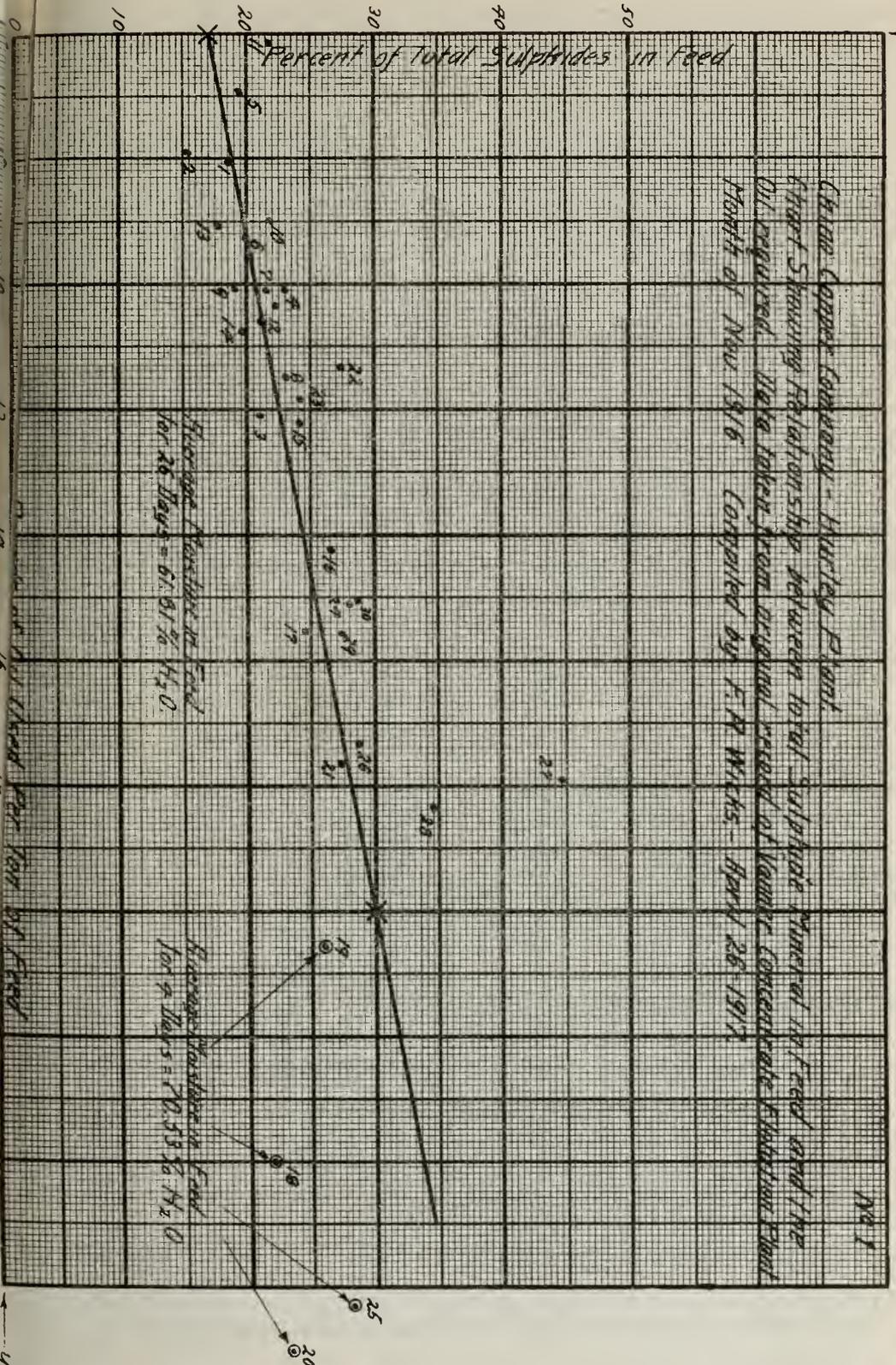
Chart showing relation between percent of sulphides in feed (taken as wt. % of insolubles) and amount of oil used. Data taken from records of year 1916 (Jan. 1 to Dec. 31 incl.) All days in which percent of water in feed was between 67.9 - 69.8.

Compiled & Plotted by W. H. Carruthers
Apr. 29 - 17

Percent of Zinc Sulphides in Feed to Flotation Plant

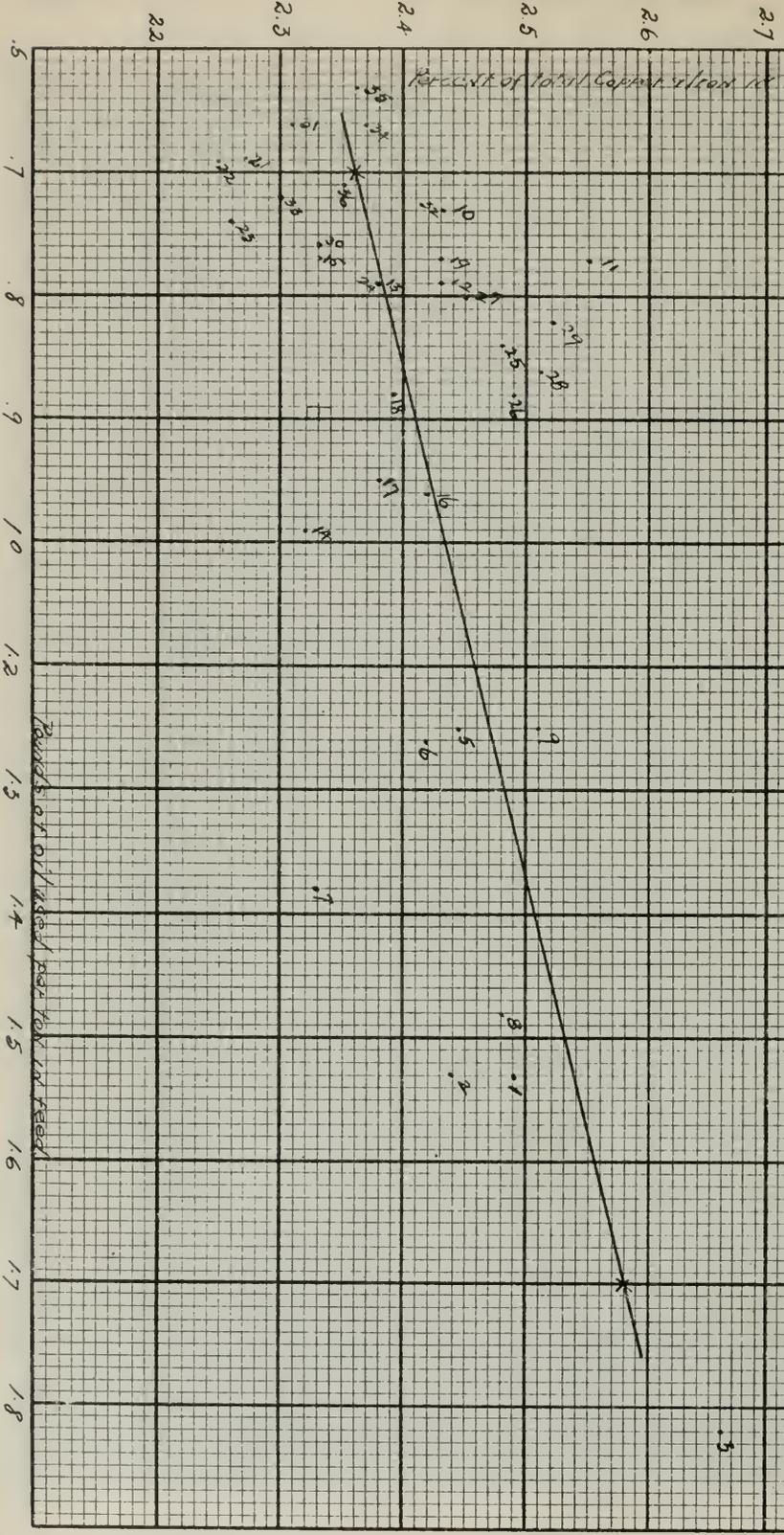
Grade and Sulphur content of Flotation Concentrate
 Chart showing the relationship between the percentage of zinc sulphides in feed and the oil used
 Data compiled from various flotation records. Material that will
 Complete 1911-1917





Very Curious case Cooper Co. Hayden Division
 Check Spinning relationship between total copper and terminal end in road, and the oil used
 But then trace of oil in road at total end still better rolling part for period
 10 days each - year 1915.
 Compiled by E. W. Engelmann Nov 30 1917

Record of Total Copper in Road



Rounds of oil used per ton in road

2.7
 2.6
 2.5
 2.4
 2.3
 2.2

0.5 0.7 0.8 0.9 1.0 1.2 1.3 1.4 1.5 1.6 1.7 1.8

Percent total Copper and Iron.

May Consolidated Copper Co. Hayden Plant
 Chart showing relationship between percent of copper and iron in feed and oil used
 Date taken from original record of Hayden Consolidated Copper Co. Hayden Plant
 for 10 day period during year 1916.
 Copied by E. W. Englehardt Nov. 30 - 1917.

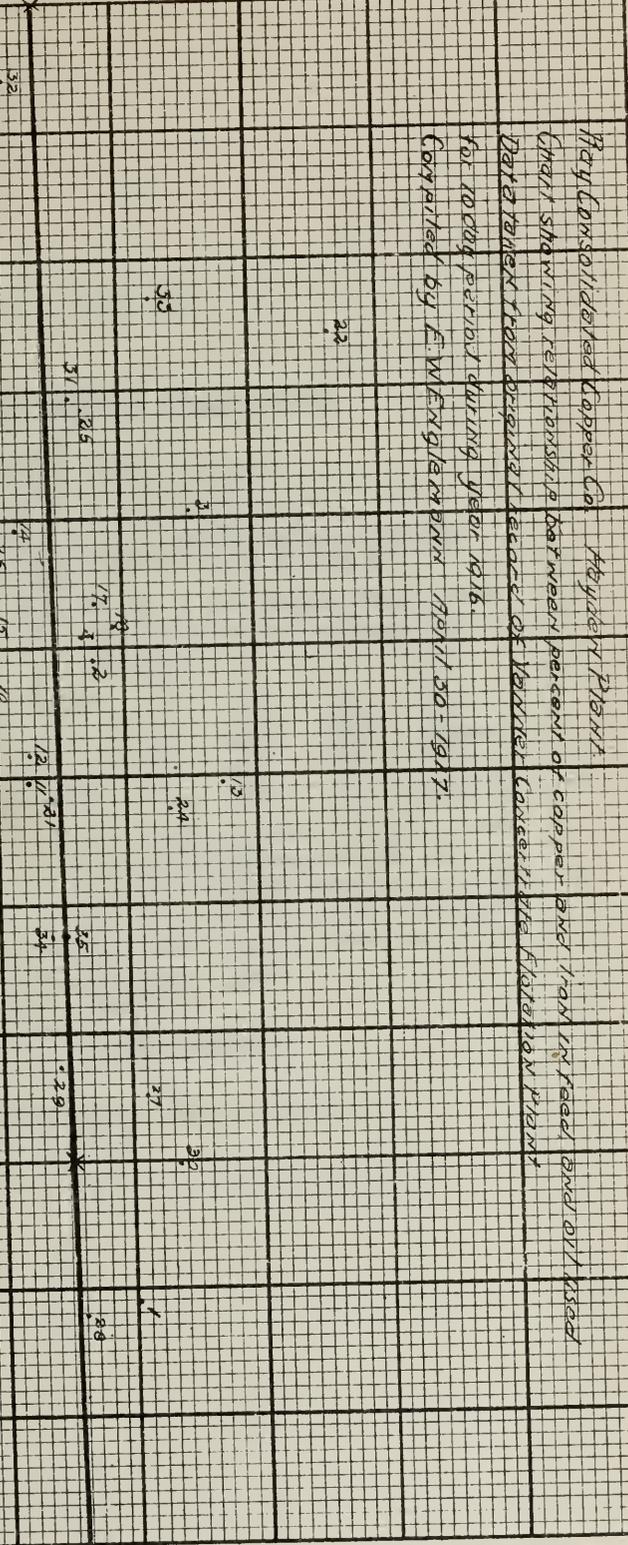
10.0

11.0

12.0

13.0

14.0



Defendant's Exhibit No. 212.

UTAH COPPER COMPANY
ARTHUR PLANT

TEST NO. 1—MACHINE NO. 1—RETREATMENT PLANT
13 CELLS, FULL FEED, NO CIRCULATION

TEST PERFORMED 9:30 P. M. TO 10:30 P. M. APRIL 21, 1917.

		% COPPER.					
	Tonnage	Total	Carb.	Sulphide	% Fe.	% Ins.	% Solids
Heading	10.1	4.700	.115	4.585			42.26
Tailing	7.1	.800	.045	.755			
Concentrate	3.0	14.150	.145	14.005	10.50	52.50	10.94
Ratio of concentration							3.42
Per cent indicated extraction (Total Cu)							87.95
Per cent indicated extraction (sulphide)							88.29
Pounds oil added							220
Pounds oil added per ton							21.78

Oils: 66% Smelter Fuel,
34% Jones

Reagent—Calura.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 213.

Defendant's Exhibit No. 213

UTAH COPPER COMPANY
ARTHUR PLANT

TEST NO. 2—MACHINE NO. 1—RETREATMENT PLANT
13 CELLS, FULL FEED, NO CIRCULATION

TEST PERFORMED 7:45 TO 8:45 P. M. APRIL 21ST, 1917.

Tonnage 24 Hrs.	% COPPER				
	Total	Carb.	Sulphide	% Fe	% Insol. % Solids
Heading .....460	4.875	.060	4.815		42.00
Tailing .....302	.462	.020	.440		20.29
Concentrate 158	13.300	.220	13.080	10.20	39.20 10.60
Ratio of concentration.....					2.91
Per cent indicated extraction (total Cu.).....					93.78
Per cent indicated extraction (sulphide).....					94.02

OIL ANALYSIS ON PRODUCTS

	Lbs. per ton
Tailing	23.16
Concentrate	491.80

OIL AND REAGENTS FOR TEST

Pounds oil added per ton.....249.83

Oils: 59% Smelter Fuel
30% Jones
10% American Creosote No. 2
1% Yaryan Pine

Reagent—Calcifer

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 214.**RAY CONSOLIDATED COPPER COMPANY
HAYDEN PLANT**

Data Compiled From Monthly Statements (Form No. 62-R) Showing
Results of Operation of Vanner Concentrate Retreatment Plant
During Year 1916.

DIVIDED INTO 10-DAY PERIODS.

These Figures Submitted Below Consist of the Missing Periods as
Shown by Similar Report Compiled by Me on April 30, 1917.

Period	Lbs. Oil Per Ton	% Water in Feed	ASSAY PLANT FEED		
			% Copper	% Iron	% Total Cu. & Fe.
4	3.60	76.00	4.78	6.14	10.92
6	3.12	73.00	5.55	6.50	12.05
20	3.04	77.00	5.55	6.86	12.41

MISSING DATA FOR SLIME VANNER TAILING PLANT.

4	1.50	80.00	.80	1.60	2.40
20 .....	.66	73.00	.72	1.54	2.26

Respectfully submitted,
(Signed) E. W. ENGELMANN,
Flotation Eng'r Ray Con. Cu. Co.
Hayden, Arizona.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 215.

URE'S DICTIONARY

OF

ARTS, MANUFACTURES, AND MINES

CONTAINING

A CLEAR EXPOSITION OF THEIR PRINCIPLES AND PRACTICE

EDITED BY ROBERT HUNT, F.R.S. F.S.S.

Keeper of Mining Records

Formerly Professor of Physics, Government School of Mines, &c. &c.

ASSISTED BY NUMEROUS CONTRIBUTORS EMINENT IN SCIENCE AND FAMILIAR WITH MANUFACTURES

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FIFTH EDITION, CHIEFLY REWRITTEN AND GREATLY ENLARGED.

IN THREE VOLUMES—VOL. III

LONDON

LONGMAN, GREEN, LONGMAN, AND ROBERTS

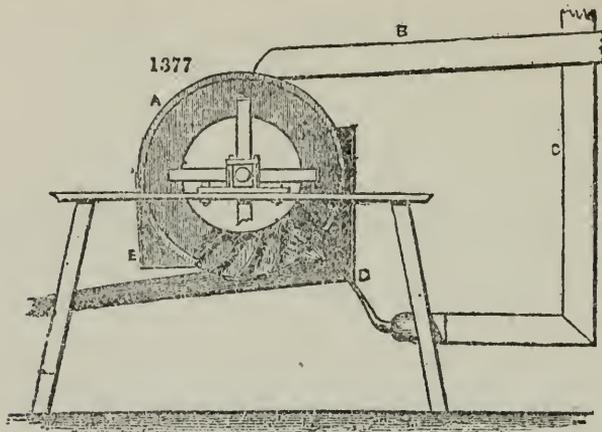
1860

331

ORES, DRESSING OF.

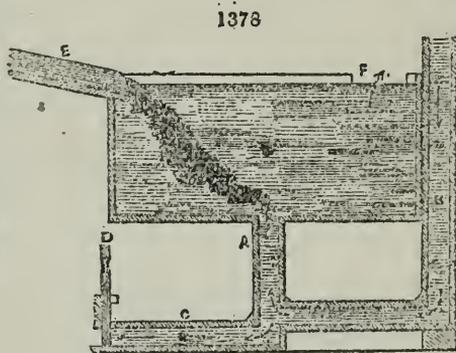
turned from a pressure-column ten feet in height, and passes directly into the funnel, of a round buddle.

The wheel *A*, *fig. 1377*, is four feet in diameter, two feet six inches in breadth; has



twenty-four buckets, and makes five revolutions per minute; *B*, launder for supplying the finely-pulverized ore; *C*, pressure-column; *D*, jet-piece; *E*, launder for conveying off the slime overflow of the wheel; *F*, launder for conveying roughs to round buddle. A modification of this apparatus is employed at the Wildberg mines in Germany, where it has been recently introduced, and is found to succeed admirably for the classification of finely-divided ores.

Sizing cistern.—The tails from round buddles are sometimes passed through this apparatus. It consists, *fig. 1378*, of a wooden box provided with an opening at the bottom, *A*, which is in communication with a pressure-pipe, *B*, an outlet, *C*, and has a small regulating sluice, *D*. The stuff from the buddles enters at *E*, and the pressure in the column is so regulated as to allow the heavier particles of the stuff to descend, but at the same time to wash away at *F* the lighter matters that may be associated with the ore. This is done by having the outlet *C* of less area than the inlet, and fixing on the extremity *D* a convenient regulating sluice by which means a greater or less quantity of stuff may be passed over the depression *F*. Two cisterns of this kind are generally employed, the second being used to collect any rough particles that may have passed off from the first. The depth of the first of these boxes may be eighteen inches, its width thirteen inches, and its length three feet six inches. The dimensions of the second may be considerably less.



The arrangement of another separating box is shown in *figs. 1379* and *1380*. The slime water flows in at *N*; and water still holding a considerable portion of slime flows away from the opposite end. It is necessary that pieces of chip, small lumps, or other extraneous matter should be intercepted previous to entering this apparatus, also that the slimes should be evenly sized by means of a trommel or sieve. The heaviest portion of the slime water in which the sand and ore is contained, is discharged at *O*, which is about an inch square. The launders *p p*, are for the purpose of conveying the slime water either to buddles or shaking tables. The dimensions of the cistern No. 1 are, length, six feet; width, one and a half feet; depth, twelve inches. But two other cisterns of similar form are attached. No. 1 cistern will work about ten tons of stuff in twenty-four hours, and by widening the box from eighteen to twenty-seven inches it will get through twenty tons in twenty-four hours. Affixed to one side of the boxes are hammers so contrived as to give thirty blows per minute in the

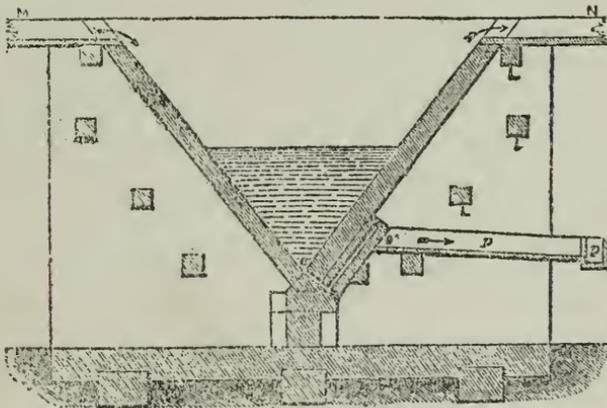
Defendant's Exhibit No. 215

ORES, DRESSING OF,

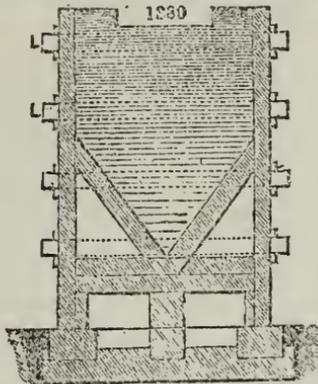
manner of a dolly tub. The sides of the box have an angle of fifty degrees from the horizontal. The chief dimensions of the two cisterns, viz. one working ten and the other twenty tons, are subjoined.

No. of Box.	Ten tons.			Twenty tons.		
	Length of Box.	Breadth of Box.	Depth of Box.	Length of Box.	Breadth of Box.	Depth of Box.
2	9	2	6	9	5	6
3	12	4	8	12	9	8
4	15	8	10	16	15	10

1379



1380



According to experiments made in the Stamping House of Schemnitz, where twelve tons are stamped in twenty-four hours, the first cistern separated from the slimes 40 per cent. of the ore; the 2nd cistern, 22 per cent.; the 3rd cistern, 20 per cent.; the 4th cistern, 12 per cent.; together, 94 per cent., leaving a loss of 6 per cent.

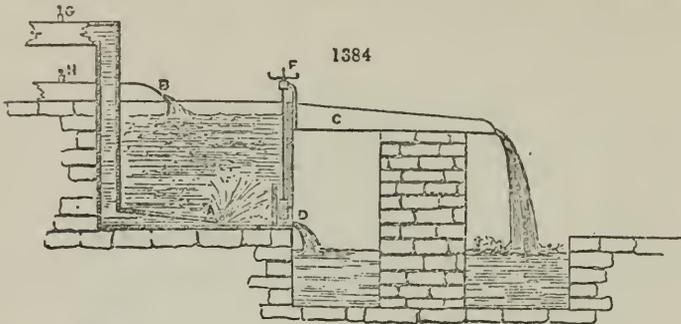
From No. 1 box every cubic foot of water flowing through gave 16 pounds of sandy matter. No. 2 afforded 13 pounds of finer stuff. No. 3, 16 pounds, and No. 4 yielded 12 pounds per cubic foot of water. It should be remarked that the outlet is proportioned to the dimensions of the machine.

335

Defendant's Exhibit No. 215

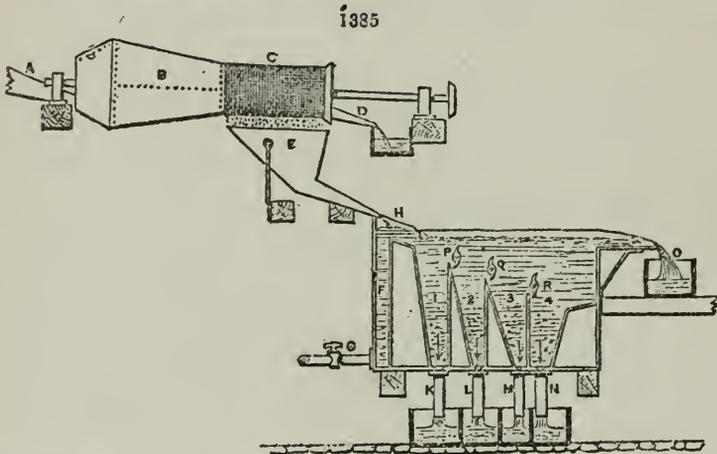
ORES, DRESSING OF.

Wilkin's separator.—This apparatus is the invention of Mr. J. B. Wilkin of Wheal Bassett and Grylls, near Helston. He describes it as a "self-acting tossing



machine, by which the rough particles are separated from the fine and prepared for the inclined plane. The ore matter is carried into a small cistern by a stream of water which enters at the top and passes out at the opposite side bearing the finer particles with it, whilst the rougher and heavier particles escape at the bottom through a rising jet of clean water, which prevents the fine and light particles from passing in the same direction." A, fig. 1384, inlet of clean water, B, launder delivering the ore matter, C, outlet of fine and inferior stuff, D, discharge orifice for rough and heavy stuff. This operation must be regulated by a flood-shut. A cistern 10 feet square on the top, and 18 inches deep will pass through about 40 tons in 10 hours. When separating stamps work a smaller cistern is employed, say 14 inches square, 10 inches deep, this will despatch 6 tons in 10 hours.

A valuable form of separator is shown in fig. 1385, the peculiarity of which consists

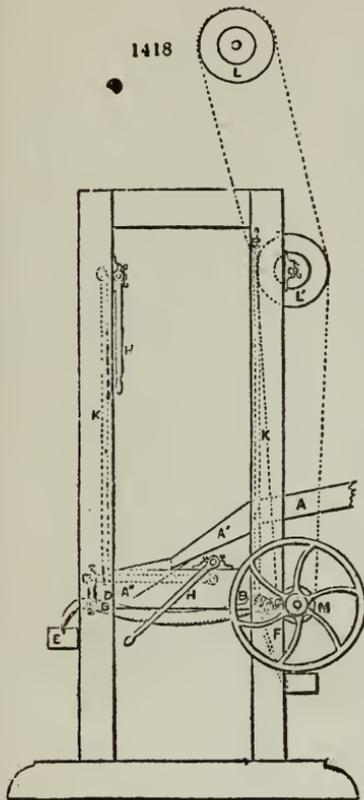


in the manner of introducing the water and slimes. Instead of the latter depending for separation upon the power of an ascending column of water, it here passes into a horizontal flow of greater or less volume and velocity, produced by altering the tap a. Compartments, viz. 1, 2, 3 and 4, are also fitted in the box, for the purpose of receiving mineral of different densities and size, which is discharged and washed in strips set underneath; A, inlet launder to trommel; B, waist of sheet iron; C, trommel either of perforated plate, or wire gauze; D, shoot from trommel serving to convey away the rougher portions; E, hopper for conveying stuff to shoot H, and from thence into the box; F, ascending column of water; G, tap for regulating the flow of water; K, L, M, N, outlet pipes for delivering the separated stuff to strips or buddles; O, launder for receiving overflow from cistern; P, Q, R, valves regulating the width of the compartments, also for the purpose of effecting the disposition of the different minerals with which the ore may be associated.

Defendant's Exhibit No. 215

ORES, DRESSING OF

frame n. The slime box A'' is perforated at D with numerous holes, each of which is fitted with small regulating pins.



The table n n is 2 feet 2 inches wide, and 2 feet 10 inches long, with a bottom formed of copper gauze. It is suspended by the vertical rods k k, and varying degrees of inclination are given to the table by altering the levers u u. For the purpose of quickening or decreasing the action of the table two cones are employed, z z', upon which the driving band is shifted as may be necessary. A band from a runner, fitted on the axis of the cone z, communicates motion to a pulley wheel, m, upon the shaft of which are cranks attached to connecting rods a, giving motion to the table.

When the machine is in operation, the ore flows over at r, into the launder beneath it, whilst the waste is carried over the opposite end into the trough z.

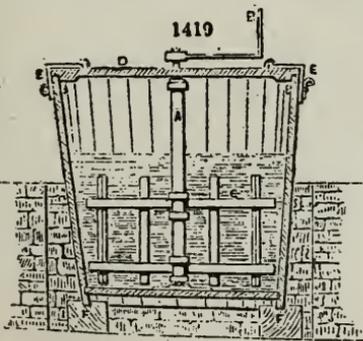
Professor B. Silliman, jun., and Mr. J. D. Whitney give the following particulars of results realised by this machine:—The total weight of ore stuff dressed during 122 days was 11,943,960 pounds of rock stamped and crushed, or 5,080 tons miners' weight.

The total ore sold from this quantity of stuff was 128 gross tons (2352 lbs.), or 2.51 per cent. of the stuff worked over. By the Captain's vans the average richness of the stamp work (forming much the larger part of what goes to the separators) for 22 weeks was 2.32 per cent. The humid assay of the average work from the stamps for five weeks in July and August, gave for the richness of the stuff dressed on the separators 3.28 per cent. of ore, or .984 per cent. of metallic copper. There is, therefore, an apparent loss in the tailings of $\frac{77}{100}$ per cent. of 30 per cent. ore, or $\frac{23}{100}$ of copper. The amount of ore, however, lost in the tailings

does not exceed $\frac{3}{10}$ to $\frac{1}{10}$ per cent., or about $\frac{15}{100}$ per cent. of copper. The actual products of working, therefore, as may be seen, exceed for the machines the average richness of the Captain's vans.

Of the total ore produced in this time, 181,126 pounds came from the separators, and 160,858 pounds from the jiggers. The whole amount of stuff therefore required to produce this amount of ore, estimated from the above ratio (1.15 : 1) is 768,680 pounds. This may be taken approximately as the actual quantity which passed over the separators, and if calculated on the Captain's vans, it should have produced 177,961 pounds of ore, while in fact it did produce 181,126 pounds, or a variation in excess for the machines of only 3,210 pounds. Each of the separators therefore dresses about $1\frac{1}{2}$ tons of rock daily, of stuff yielding an average of 2.5 per cent. of 30 per cent. ore.

Dolly tub or packing kieve.—This apparatus is employed for the purpose of excluding fine refuse from slime ore, which has been rendered nearly pure by previous mechanical treatment. In using it the workmen proceed thus:—The kieve, fig. 1419, is filled to a certain height with water, and the dolly A introduced. A couple of men then take hold of the handle B, and turning it rapidly cause the water to assume a circular motion. The tossing is then

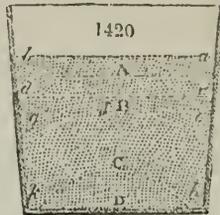


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ORES. DRESSING OF

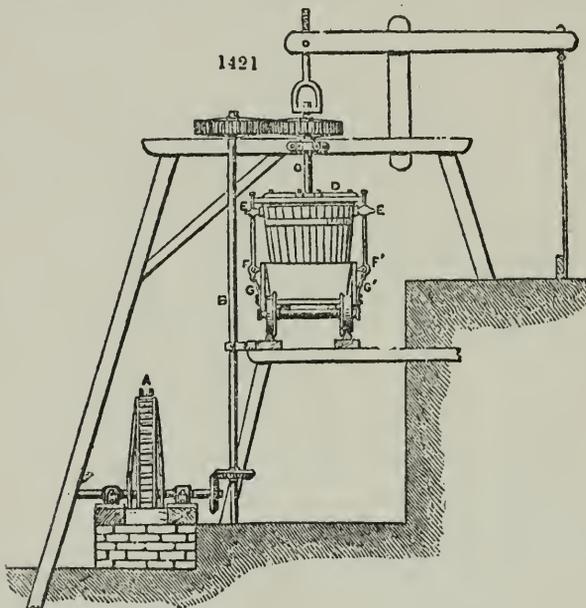
commenced by shovelling in the slime until the water is rendered somewhat thick. After continuing the stirring for a short period, the hasps *E E* are loosened, and the bar *D* with the dolly are suddenly withdrawn. The tub is then packed by striking its outside with heavy wooden mallets. When this operation is terminated, the water is poured off through plug-holes in the side of the tub.

The object of the rotary motion created by the dolly is to scour off clayey or other matter adhering to the ore, whilst the packing hastens the subsidence of the denser portions. In one operation of this kind four distinct strata may be procured, as indicated by the lines *a b, c d, e f g, h c h*, in *fig. 1420*.



The upper portion, viz. from *A* to *B*, will probably have to be set aside for further washing, whilst the schlich *C* should be fit for market. The conical nucleus in the centre of the tub generally consists of coarse sand, and is usually further enriched on a copper bottom sieve, or else submitted to the action of a tye, or other suitable apparatus.

Machine dolly tub. — This kieve is packed by machinery represented in the accompanying woodcut, in which *A* is a small water-wheel working a vertical shaft *n*, and driving another shaft *o*. At the bottom of this is fixed a notched wheel *D*, which

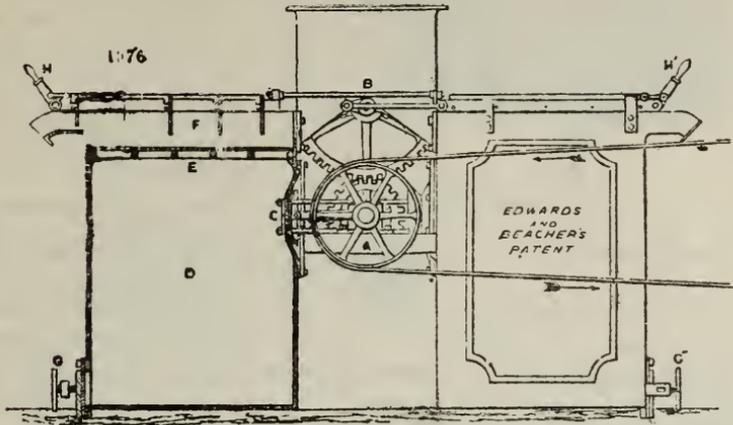


presses outwardly the hammers *E E*; these are mounted upon iron bars *F F'*, and violently driven upon the side of the kieve by means of springs *G G'*.

The degree to which ore can be concentrated by dollying must evidently depend upon several conditions: — 1st. The initial percentage of the ore. 2nd. The condition to which it is reduced. 3rd. The matrix with which it is associated. 4th. The proportion of water employed. And lastly, if the rotation and packing have been judiciously performed. An experiment upon some sandschlich lead ore, much intermixed with fine carbonate of iron, gave the following results: —

Introduced into dolly tub, 17 cwt., assayed, 48%.	
Time required to introduce stuff	6 minutes.
Dolly rotated	5 "
Dolly withdrawn —	
Tub packed	5 "
Running off water	6 "
Skimming and cleaning out tub	20 "
Total	42

B, which is driven at a slower rate by means of toothed wheels, and gives by cranks or eccentrics, a horizontal motion backwards and forwards to sets of scrapers **F**, above



the cisterns. These are so arranged as to remove the upper stratum of the substance being acted upon, and discharge it into waggons or other convenient receptacles; these upper strata are of course the lightest, the heavier part settling upon the perforated plates below.

When from the action of the machine a considerable quantity of material has accumulated upon these plates, the scrapers are thrown out of gear by means of apparatus attached to **H B**, and the stuff raked off, the operation being then continued on fresh supplies. Doors, **C C**, at the bottom of the machines admit of any fine stuff which may pass through the perforated plates being removed from time to time as may be necessary.

These machines are in use for cleansing coal as well as other mineral substances.

In such cases the heavier stuff which remains upon the plates consists of shale, pyrites, &c., very injurious substances in the manufacture of coke. One machine of two connected cisterns, is capable of washing about thirty tons per diem of coal, but the quantity of mineral work will depend upon the amount of ore present in proportion to the waste. The size of the perforations in the screens is adapted to the quality of the material acted upon.

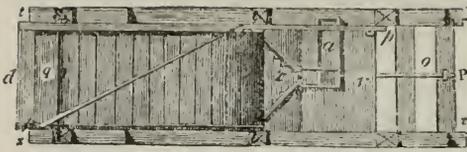
A gold washing machine has been arranged by Mr. John Huut, late of Pont-Pean, France. This gentleman states that it requires but little water, and is so contrived, as to circulate this water for repeated use; also that the principle would be found very successful if employed on a more extended scale; this Mr. Huut intends to carry into operation at some lead mines in Cornwall.

SEPARATORS

Of late years apparatus of this class has been steadily coming into operation, not only in lead and copper mines, but also in the dressing of tin ores. The prevailing principle is that of directing a pressure of water against the density of the descending material, making the former sufficiently powerful to float off certain minerals with which the ore may happen to be associated. When marked difference of densities exist, and the ore can be readily freed from its gangue, this mode of separation will be found effective. Trommels may be advantageously employed for sizing the stuff previous to its entry into the several separators.

Slime separator.—This apparatus is due to Captain Isaac Richards, of Devon Great Consols, and is employed for removing the slime from the finely-divided ores which have passed through a series of sieves set in motion by the crusher. The finely-divided ores are for this purpose conveyed by means of a launder upon a small water-wheel, thereby imparting to it a slow rotary motion. Whilst this is turning time is allowed for the particles to settle in accordance with their several densities; the result obtained is that the heavier and coarser grains are found at the bottom of the buckets, whilst the lighter and finer matters held in suspension are poured out of the buckets and flow away through a launder provided for that purpose. The stuff remaining in the bottom of the buckets is washed out by means of jets of water ob-

685r



685s

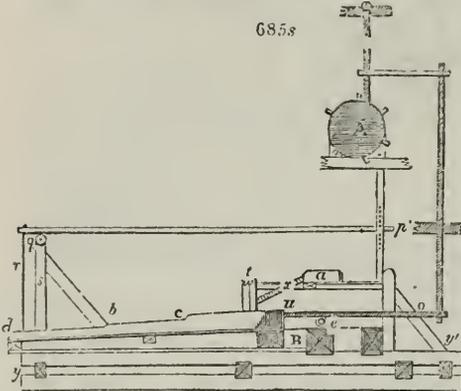
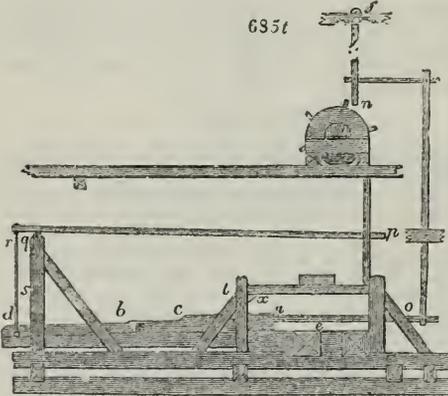


table is suspended by two chains *t*, at its superior end, and by two rods at its lower end. After having been pushed by the piece, *o, u*, it rebounds to strike against a block or bracket *B*. A lever *p, q*, serves to adjust the inclination of the movable table, the pivots *g* being points of suspension.

The stuff to be washed, is placed in the chest *a*, into which a current of water runs. The ore, floated onwards by the water, is carried through a sieve on a small sloping table *x*, under which is concealed the higher end of the movable table *d, b, c, u*; and it thence falls on this table, diffusing itself uniformly over its surface. The particles deposited on this table form an oblong *talus* (slope) upon it; the successive percussions that it receives, determine the weightier matters, and consequently those richest in metal,

635t



c, u. Each of these bands is removed separately and thrown into the particular heap assigned to it. Every one of the heaps thus formed becomes afterwards the object of a separate manipulation on a percussion table, but always according to the same procedure. It is sufficient in general to pass twice over this table the matters contained in the heap, proceeding from the superior band *c, u*, in order to obtain a pure *schlich*; but the heap proceeding from the intermediate belt *b, c*, requires always a greater number of manipulations, and the lower band *d, b* still more. These successive manipulations are so associated that eventually each heap furnishes pure *schlich*, which is

This machine was in constant use at the Great Polgooth Mine for some time, and it is said effected a saving of 30 per cent. in the dressing of slime ore. It is not so well adapted for rough as for the treatment of fine slimes; the apparatus may be managed by a boy at 8*d.* per day, and the cost of the machine complete is about 60*l.*

Percussion table or Stossheerd.

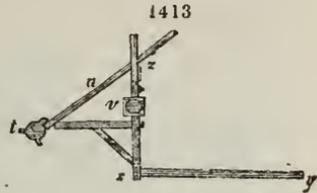
— The diagrams, *figs.* 685*r*, 685*s*, and 685*t*, exhibit a plan, vertical section, and elevation of one of these tables, used in the Harz. The arbor or great shaft, is shown in section perpendicularly to its axis, at *A*. The cams or wipers are shown round its circumference, one of them having just acted on *n*.

These cams, by the revolution of the arbor, cause the alternating movements of a horizontal bar of wood, *o, u*, which strikes at the point *u* against a table *d, b, c, u*. This

to accumulate towards its upper end at *u*. Now the workman by means of the lever *p*, raises the lower end *d* a little in order to preserve the same degree of inclination to the surface on which the deposit is strewed. According as the substances are swept along by the water, he is careful to remove them from the middle of the table towards the top, by means of a wooden rake. With this intent, he walks on the table *d, b, c, u*, where the sandy sediment has sufficient consistence to bear him. When the table is abundantly charged with the washed ore, the deposit is divided into three bands or segments *d, b, c, u*.

obtained from the superior band *c u*. As to the lightest particles which the water sweeps away beyond the lower end of the percussion table, they fall into launders, whence they are removed to undergo a new manipulation.

Fig. 1413 is a profile of a plan which has been advantageously substituted, in the Harz, for that part of the preceding apparatus which causes the jolt of the piece *ou* against the table *d b c u*. By means of this plan, it is easy to vary, according to the circumstances of a manipulation always delicate, the force of percussion which a bar *x y*, ought to communicate by its extremity *y*. With this view a slender piece of wood *u* is made to slide in an upright piece, *v x*, adjusted upon an axis at *v*. To the piece *u* a rod of iron is connected, by means of a hinge *z*; this rod is capable of entering more or less into a case or sheath in the middle of the piece *v x*, and of being stopped at the proper point, by a thumb-screw which presses against this piece. If it be wished to increase the force of percussion, we must lower the point *z*; if to diminish it, we must raise it. In the first case, the extremity of the piece *u*, advances so much further under the cam of the driving shaft *t*; in the second, it goes so much less forwards; thus the adjustment is produced.



The water for washing the ores is sometimes spread in slender streamlets, sometimes in a full body, so as to let two cubic feet escape per minute. The number of shocks communicated per minute, varies from 15 to 36; and the table may be pushed out of its settled position at one time three quarters of an inch, at another nearly 8 inches. The coarse ore-sand requires in general less water, and less slope of table, than the fine and pasty sand.

The following remarks on the Freiberg *shaking table*, are by Mr. Upfield Green, of the Wildberg Mines, Prussia. The bed of the table is about fourteen feet long, six feet wide, and is formed of double one-inch boards, fastened to a stout frame. The table is hung by four chains, the two hindmost are generally two feet long with an inclination of 2 to 4 inches. The two front ones, which are attached to a roller for the purpose of altering the inclination of the table, are five feet six inches long, and hang perpendicularly when the table is at rest.

The table receives its action from cams inserted in the axle of a water-wheel, acting on the knee of a bent lever. The slimes after being thoroughly stirred up by a tormentor, are conveyed by a launder in a box, where they are still further diluted with clean water, and passing through a sieve with apertures corresponding to the size of the grain to be dressed, flow upon an inclined plane furnished with diffusing buttons, and from thence drip on to the shaking table.

In treating rough slimes the two hindmost chains are set at an inclination of 5 to 6 inches, and the table with an inclination of 4 to 6 inches on its length, makes 36 to 39 pulsations of 5 to 6 inches in length per minute. About 2½ cubic feet of diluted slimes, twelve of clean to one of slime-water, enter the table per minute.

Before commencing the percussive action, the table is covered with a thin layer of rough slimes, and during the first few minutes only clean water is admitted. In consequence of the quantity of water and violent motion employed, the smaller and lighter particles of ore are likely to drift down the table, and a rake is therefore employed at intervals to reconvey such particles towards the head of the table. Care must, however, be taken not to allow the water to wear furrows in the deposit. From two to three hours are usually required for the roughest sand-slimes to deposit four to five inches on the head of the table. The crops are twice more passed over the shaking table and afterwards doliied. The rapidity of movement and quantity of clean water increase with each operation. The tails of the first operation, which are considerably poorer than the original stuff, may be either thrown away, or once more passed over the table, when the crop will be fit for treatment along with a fresh quantity of original slime. The treatment of fine slimes is similar to that of the rough, with the exception that the inclination of the table, quantity of slime-water, proportion of clean water, and length of stroke, constantly decrease with the degree of fineness of the slime; and the number of strokes increase in proportion. In fact, for the finest slimes, the table has no greater inclination than one inch on its whole length, while the stroke, of which 35 to 45 per minute are made, is no longer than ¼ to ½ an inch. The time required for dressing varies with the nature of the slime operated on, five tons of rough slimes occupies sixty-eight hours, whilst the same quantity of very fine slimes requires no less than four times that period.

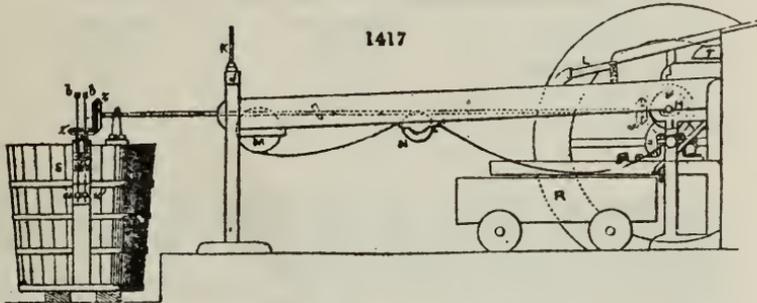
The *Stossherde*.—To the kindness of Mr. Charles Remfry, of Stolberg, I am indebted for the elevation of a *stossherde* erected at the Breinigerberg Mines, under

process consists in letting flow, over the sloping table; in successive currents, water charged with the ore, which is deposited at a less or greater distance, as also pure water for the purpose of washing the deposited ore, afterwards carried off by means of this operation.

At the upper end of these *sweeping-tables*, the matters for washing are agitated in a chest, by a small wheel with vanes, or flap-boards. The conduit of the muddy waters opens above a little table or shelf; the conduit of pure water, which adjoins the preceding, opens below it. At the lower part of each of these tables, there is a transverse slit, covered by a small door with hinges, opening outwardly, by falling back towards the foot of the table. The water spreading over the table, may at pleasure be let into this slit, by raising a bit of leather which is nailed to the table, so as to cover the small door when it is in the shut position; but when this is opened, the piece of leather then hangs down into it. Otherwise the water may be allowed to pass freely above the leather when the door is shut. The same thing may be done with a similar opening placed above the conduit. By means of these two slits, two distinct qualities of *schlich* may be obtained, which are deposited into two distinct conduits or canals. The refuse of the operation is turned into another conduit, and afterwards into ulterior reservoirs, whence it is lifted out to undergo a new washing.

Brunton's machine.—This apparatus appears to be well adapted for the utilisation of the ore contained in very fine slimes. At Devon Great Consols it is extensively employed, not only to concentrate the viscid kind of slime sometimes found at the periphery of the round buddle, but also to dress the tops and middles resulting from the dollying operation.

The small water-wheel, shown in *fig. 1417*, is sufficient to drive six of these



machines, viz. three on each side. Before the stuff is permitted to enter upon the rotating cloth, it is disintegrated by tormentors, and passed through a sizing trommel; it then flows over the head or dispersing board L, on to the cloth. This cloth rotates towards the stream on two axes, n and m, and is supported by a third roller r. It is also stiffened in its width by numerous laths of wood. Clean water is introduced behind the entrance of the slime, in order to give it the proper consistency. Different degrees of inclination are given to the cloth by raising or lowering the roller m, by means of the screw k. The heavier particles lodged on the cloth are caught in the waggon r, whilst the lighter matter is floated over the roller m. The following particulars are furnished by Captain Isaac Richards, of Devon Great Consols:—

One revolution of the cloth is made in $4\frac{1}{2}$ minutes; its length is about $29\frac{1}{2}$ feet, so that it travels say $6\frac{1}{2}$ feet per minute. Its width is four feet two inches.

Before the slime comes upon the cloth it is reduced to a size of $\frac{1}{60}$ of an inch, and yields an average of $1\frac{1}{2}$ of copper; but by means of this machine the stuff is concentrated so as to afford 5 per cent. In ten hours it will clean $1\frac{1}{2}$ tons, at a cost of 1s. per ton. The speed of the cloth must, however, be varied with the condition of the stuff; if it be very poor the cloth must travel very much slower, since the enrichment requires a longer period of time.

At the end of the machine, and worked by the same water-wheel, is a dolly tub; but the dimensions and mode of working this apparatus are fully stated page 356.

Bradford's slime apparatus, *fig. 1418*, has been extensively employed at the Bristol Mines, situated in Connecticut, United States.

Its action is intended to imitate that of the vanning shovel. The slime enters by the launder A, about 5 inches wide, and descends on the inclined head A', which expands from the width of the launder to within a few inches of the width of the table

affords very little natural fall. In such case the enrichment of ores becomes more expensive from the necessity of shifting some of the various products by manual labour, and of introducing lifting appliances in order to procure the requisite elevations for carrying out the various elaborative processes. It is, moreover, scarcely practicable from the conformation of the ground to form useful reservoirs of water within a reasonable distance; neither does it commonly occur in such cases that a free supply can be obtained for washing.

The pumping engine is therefore required to furnish the requisite quantity of water. This is generally conveyed over the floors by wood launders, often interfering with each other and obstructing the direct circulation of carts, railways, &c. Now if a stand-pipe or pressure column were erected at the engine, and a main judiciously laid throughout the floors, it is obvious that it would not only remedy this evil, but also afford water for the several washing purposes, as well as motive power for common, dash, or other wheels, together with turbines, flap jacks, &c.

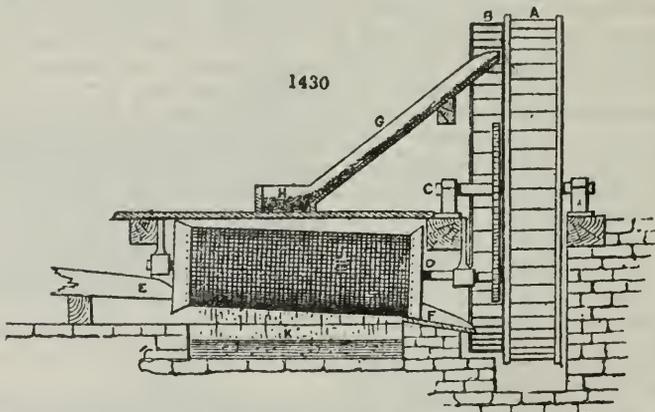
When an inconsiderable proportion of water has only to be raised to a higher level the common shoe or chain-pump will be found to render effective service; but when a larger stream is requisite it would be better to employ the rotary pump. This pump, *fig. 1429*, has been brought to great perfection by Messrs. Gwynne; A is the suction-pipe, and B the discharge, the dotted lines showing the discharge B, horizontal when required.

Pumps of the following dimensions are stated to raise and discharge per minute for medium lifts, say from 10 to 70 feet high:—

Diameter of discharge-pipe.	Diameter of suction-pipe.	Gallons of water per minute.
1½ inches.	2 inches.	25
3 "	4 "	70
4 "	5 "	150
5 "	6 "	300
6 "	7 "	500
7 "	8 "	1400

Stuff consisting of slimes and sand may be readily elevated by means of a Jacob's ladder or the Archimedean screw, illustrated at page 437, Vol. I. *fig. 269*. For short elevations combined water and raff wheels devised by Mr. Charles Remfry of Stolberg, Prussia, may be advantageously employed.

Fig. 1430, A, water-wheel; B, raff or inverted wheel; C, axis of both raff and water wheels, carrying a tooth driving wheel; D, sizing trommel; E, launder for inlet of stuff;



F, discharge launder; O, shoot delivering water and raff to launder H; K, cistern receiving slime from trommel.

Slime pits.— In the several operations of cleansing ores from mud, in grinding, and washing, where a stream of water is used, it is impossible to prevent some of the fluely attenuated portions floating in the water from being carried off with it.

Slime pits or *labyrinths*, called *budlle holes* in Derbyshire, are employed to collect that matter, by receiving the water to settle at a little distance from the place of agitation.

These basins or reservoirs are of various dimensions, and from 24 to 40 inches deep. Here the suspended ore is deposited, and nothing but clear water is allowed to escape.

The workmen employed in the mechanical preparation of the ores are paid, in Cumberland, by the piece, and not by day's wages. A certain quantity of crude ore is delivered to them, and their work is valued by the *bing*, a measure containing 14 cwt. of ore ready for smelting. The price varies according to the richness of the ore. Certain qualities are washed at the rate of 2s. 6d., or 3s. the bing; while others are worth at least 10s. The richness of the ore varies from 2 to 20 bings of galena per *shift* of ore; the shift corresponding to 8 waggon loads.

It is not essential to describe the dressing routine observable in any particular mine, since it is scarcely possible to observe the same system in any two distinct concerns. In the various modes of treatment, however, it may be remarked that the two leading features will always be *reduction* to a proper size and *separation* of the ore from the refuse. Until the *vain stuff* arrives at the crusher or stamps, the labour is chiefly one of picking and selecting, but from these machines usually commence a long series of divisions, sub-divisions, selections, and rejections. To follow these out in their various ramifications would not only exceed the limits of this paper, but would perhaps be misunderstood by those not intimately acquainted with the subject.—J. D.

OREIDE, a new brass, is the name given by MM. Meurier and Valient, of Paris, to an alloy which has a golden brilliancy.

Copper	-	-	100	Sal ammonia	-	-	3.6
Zinc	-	-	17	Quicklime	-	-	1.80
Magnesia	-	-	6	Tartar of commerce	-	-	9

The copper is first melted and then the other things are added, by small portions at a time, skimming and keeping in fusion for about half an hour.

The oreid has a fine grain, malleable, takes a most brilliant polish, and has its complexion restored by the use of acidulated water. This brass melts at a comparatively low temperature. The zinc replaced by tin gives an alloy of greater brilliancy.

ORIENTAL AMETHYST. The name given to the violet or lilac-blue variety of sapphire. It forms the passage between that gem and the ruby.

ORIENTAL EMERALD. The name given to green sapphire.

ORIENTAL TOPAZ. The name given to yellow sapphire.

OR-MOLU. A brass in which there is less zinc and more copper than in the ordinary brass; the object being to obtain a nearer imitation of gold than ordinary brass affords. In many of its applications the colour is heightened by means of a gold lacquer, but in some cases, and as we think with very great advantage, the true colour of the alloy is preserved after it has been properly developed by means of dilute sulphuric acid.

ORPIMENT (Eng. and Fr.; *Yellow sulphide of arsenic*; *Opment*; *Rauschqelb*, Germ.) is found native in many parts of the world; in Hungary, Turkey, China, &c.; the finest specimens being brought from Persia, in brilliant yellow masses, of a lamellar texture, called golden orpiment.

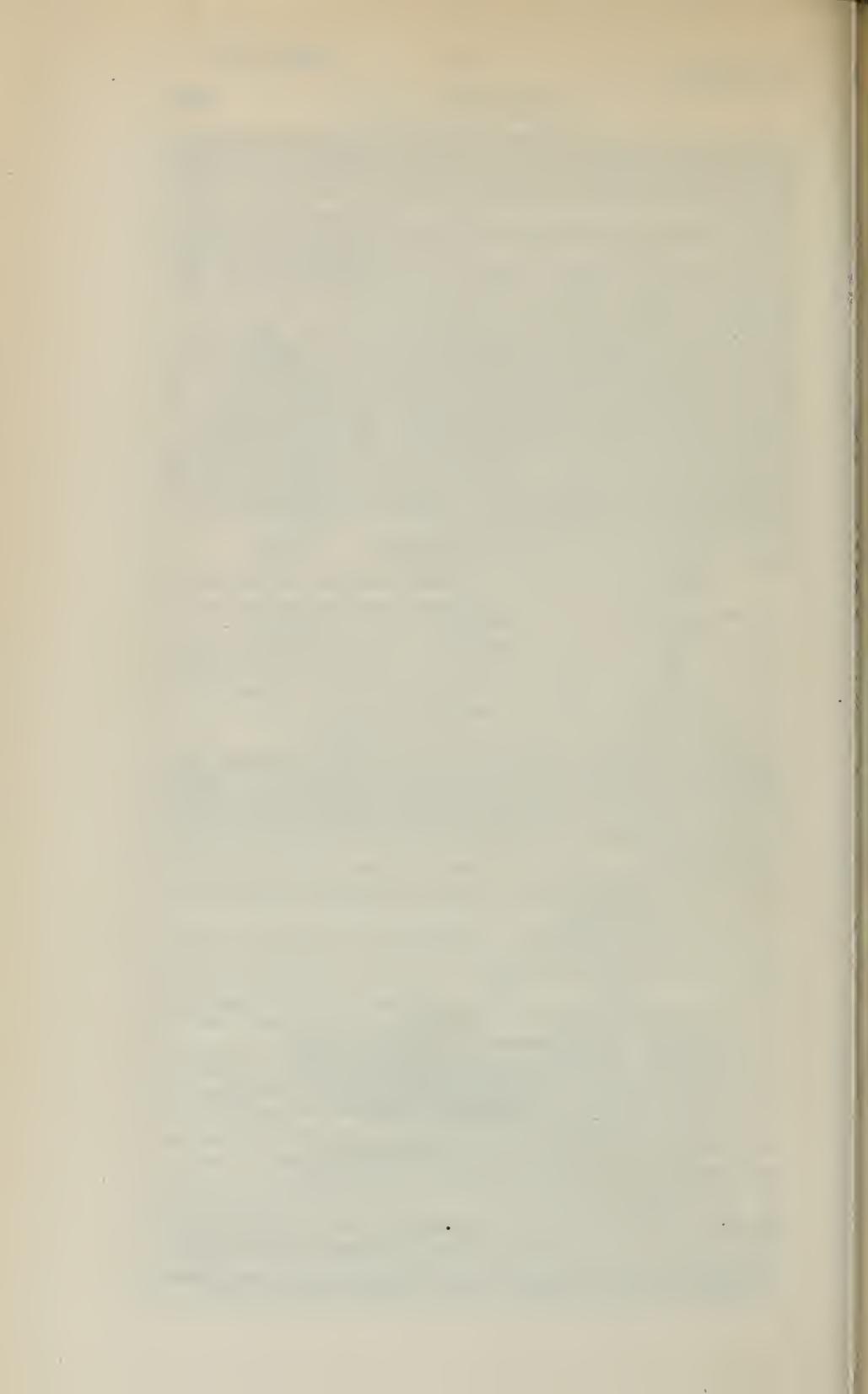
Native orpiment is the *auripigmentum*, or *paint of gold*, of the ancients. It was so called in allusion to its use and its colour, and also because it was supposed to contain gold. From this term, the common name of "orpiment," or "gold paint," has been derived.

In nature it is found most generally in amorphous masses of a bright yellow colour, but sometimes in crystals, which are oblique rhombic prisms; these crystals are flexible, of a yellow colour, and possess a brilliant lustre.

Native orpiment has a specific gravity of about 3.48. Orpiment is also prepared artificially, chiefly in Saxony, by subliming in cast-iron cucurbits, surmounted by conical cast-iron capitals, a mixture in due proportions of sulphur and arsenious acid. As thus obtained, it is in yellow compact opaque masses, of a glassy aspect; yielding a powder of a pale yellow colour.

Artificial orpiment seems to be a substance of uncertain composition, it containing sometimes, according to Guibourt, 94 per cent. of arsenious acid, and only 6 per cent. of the tersulphide of arsenic. On this account it is much more soluble in water than the native orpiment, and consequently a much more powerful poison. It has been administered several times with criminal intentions, and in many of the cases proved fatal. Orpiment is the colouring matter of the pigment called king's yellow, which is a mixture of arsenious with a little tersulphide of arsenic, just as the sample analysed by Guibourt.

A proper tersulphide of arsenic may be obtained by passing a stream of sulphuretted



Second Edition.]

N^o 10,929

A.D. 1910

Date of Application, 3rd May, 1910

Complete Specification Left, 25th Nov., 1910—Accepted, 16th Feb., 1911

PROVISIONAL SPECIFICATION

Improvements in or relating to Ore Concentration.

We, THEODORE JESSE HOOVER, Metallurgist and Consulting Engineer, and MINERALS SEPARATION LIMITED, both of No. 62, London Wall, in the City of London, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in ore concentration. Various processes are known in which one constituent such as the metallic sulphide in an ore is separated from another constituent by gaseous flotation in a liquid. The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the Patent No. 12,788/1902 describes a process of ore concentration which consists in mixing the finely powdered ore with water, adding a suitable oil and then liberating a gas in the mixture so as to carry the oiled particles to the surface in the form of a froth, and the present invention is particularly applicable to a process of this general type.

According to this invention the method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles consists in bringing the ore pulp into contact with a porous medium through which air or other gas is caused to pass. Thus according to one method the pulp is introduced into a vessel having one or more porous walls through which air or other gas can be caused to pass.

The porous media employed according to this invention may consist of plates of porous ceramic material, porous brick, coke, or felt or other fibrous material suitably supported.

The gas which is caused to pass through the porous medium into the ore pulp may be air, or furnace gases or it may be a gas produced chemically such as carbonic acid liberated from a carbonate or the gas may be produced electrolytically, or the gas which is passed through the porous medium may act both as selective agent and as frothing agent; a gas such as formaldehyde or carbon bisulphide vapour can be thus employed. The introduction of the gas through the porous medium may be effected either by pressure or by suction.

This invention is applicable in conjunction with various processes of ore concentration and a number of different means can be employed for carrying the invention into effect. For example, after agitating an ore pulp with an oil in such a way as to agglomerate metalliferous particles into granules according to the British Patents Nos. 26,295/1902, 17,109/1903 and 18,589/1903, the pulp containing the granules and also uncoiled particles can in any suitable vessel be brought into contact with a porous medium through which air or gas is caused to pass in minute bubbles or streams whereby the granules are carried to the surface of the pulp.

A number of ways are known for treating an ore pulp to facilitate or to render possible the selective flotation of certain constituent particles in the form of a gaseous froth, see for example the processes described in Patents Nos. 12,778/1902, 7803/1905, 28,173/1908 and 2359/1909. The present invention may be used in conjunction with any such processes, that is to say, the

Improvements in or relating to Ore Concentration.

which consists in mixing the finely powdered ore with water, adding a suitable oil and then liberating a gas in the mixture so as to carry the oiled particles to the surface in the form of a froth, and the present invention is particularly applicable to a process of this general type.

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- 10 or other gas can be caused to pass.

The porous media employed according to this invention may consist of plates of porous ceramic material, porous brick, coke, or felt or other fibrous material suitably supported.

- The gas which is caused to pass through the porous medium into the ore pulp may be air, or furnace gases or it may be a gas produced chemically such as carbonic acid liberated from a carbonate or the gas may be produced electrolytically, or the gas which is passed through the porous medium may act both as selective agent and as frothing agent; a gas such as formaldehyde or carbon bisulphide vapour can be thus employed. The introduction of the gas
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- 25 an acid in solution and with or without an immiscible frothing agent such as oil or soluble frothing agent such as amyl-alcohol; and the pulp may be used at any temperature found suitable.

- In one method of carrying this invention into effect a pulp of the kind described is passed intermittently or continuously into a vessel having one or more porous walls behind which a gas such as air is supplied under pressure so that the gas is forced through the porous diaphragm and in the form of minute bubbles is disseminated throughout the ore pulp. This method of introducing the gas may have three functions. The gas may bring about the necessary agitation of the pulp. The gas being in the state of very fine division is effectively brought into contact with every mineral particle. The fine bubbles of gas readily come to the surface of the pulp in the form of a froth.
- 30 Referring to the Patent No. 29,374/1904 the ore pulp is passed over a table on which flotation of the metalliferous particles takes place. According to this invention such a table may have a porous top through which air or other gas under pressure may be introduced into the pulp to effect the flotation of certain particles.

- Referring to Patent No. 7803/1905 it is suggested to conduct the agitated pulp to the spritzkasten over a flat trough. According to this invention such a trough may have a porous bottom through which air or other gas is forced, under pressure, so as to create or improve the mineral-bearing froth.
- 35 Apparatus for use according to this invention is conveniently continuous in

Page transferred

Improvements in or relating to Ore Concentration.

crushed ore may be mixed in any convenient way with water with or without an acid in solution and with or without an immiscible frothing agent such as any or soluble frothing agent such as amyl-alcohol, and the pulp may be used at any temperature found suitable

In one method of carrying this invention into effect a pulp of the kind described is passed intermittently or continuously into a vessel having one or more porous walls behind which a gas such as air is supplied under pressure so that the gas is forced through the porous diaphragm and in the form of minute bubbles is disseminated throughout the ore pulp. This method of producing the gas may have three functions. The gas may bring about the necessary agitation of the pulp. The gas being in the state of very fine division is effectively brought into contact with every mineral particle. The fine bubbles of gas readily come to the surface of the pulp in the form of a froth.

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Referring to Patent No. 7803/1905 it is suggested to conduct the agitated pulp to the spitzkasten over a flat trough. According to this invention such a trough may have a porous bottom through which air or other gas is forced, under pressure, so as to create or improve the mineral-bearing froth.

Apparatus for use according to this invention is conveniently continuous in operation. Thus the ore pulp may be passed through a conduit having walls partly made of porous material and surrounded by a jacket to which compressed air is supplied and the pulp emerging from said conduit may discharge into a spitzkasten.

The supply of compressed air may be produced by induction methods by the flow of the pulp itself.

The porous medium may constitute the wall of a pulp vessel or it may be in the form of tubes, hollow gratings, or boxes in the pulp vessel.

The details of the method and apparatus may be varied without departing from this invention.

Dated this 3rd day of May, 1910.

BOULT, WADE & TENNANT,
111/112, Hatton Garden, London, E.C.,
Chartered Patent Agents.

COMPLETE SPECIFICATION.**Improvements in or relating to Ore Concentration.**

We, THEODORE JESSE HOOVER, Metallurgist and Consulting Engineer, and MINERALS SEPARATION LIMITED, both of No. 62, London Wall, in the City of London, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in ore concentration. Various processes are known in which one constituent such as the metallic sulphide in an ore is separated from another constituent by gaseous flotation in a liquid. The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the Patent No. 12,778 of 1902 describes a process of ore concentration

Defendant's Exhibit No. 216

N^o 10,929 —A D. 1910.*Improvements in or relating to Ore Concentration.*

operation Thus the ore pulp may be passed through a conduit having walls partly made of porous material and surrounded by a jacket to which compressed air is supplied and the pulp emerging from said conduit may discharge into a spitzkasten.

The supply of compressed air may be produced by induction methods by the flow of the pulp itself, by any of the well known methods for obtaining a supply of compressed air by the fall or flow of a liquid.

The porous medium may constitute the wall of a pulp vessel or it may be in the form of tubes, hollow gratings, or boxes in the pulp vessel.

The details of the method and apparatus may be varied without departing from this invention

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles which consists in bringing the ore pulp into contact with a porous medium through which the air or other gas is caused to pass.

2. The method of introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain particles which consists in introducing the pulp into a vessel having one or more porous walls through which air or other gas can be caused to pass.

3. The method of concentrating ores which consists in mixing the crushed ore with water and with a mineral-frothing agent and introducing air or other gas into the pulp through a porous medium adapted to subdivide the gas into extremely fine streams or bubbles.

4. The method of concentrating ores which consists in agitating the ore pulp with a mineral-frothing agent and passing the pulp over a table having a porous top or over a trough having a porous bottom through which porous parts air or other gas under pressure is introduced into the pulp to effect flotation of certain particles.

5. Apparatus for introducing air or other gas into an ore pulp for the purpose of effecting flotation of certain mineral particles which comprises a porous surface (for example the wall or walls of a containing vessel, the surface of a flotation table or a duct) with which the ore pulp comes into contact at one period of its treatment, and through which air or other gas may be forced or drawn into the pulp.

6. Apparatus substantially as described, for introducing air or other gas into an ore pulp for the purpose of effecting the flotation of certain mineral particles.

Dated this 23rd day of November, 1910.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London, E.C.1.
Chartered Patent Agents.

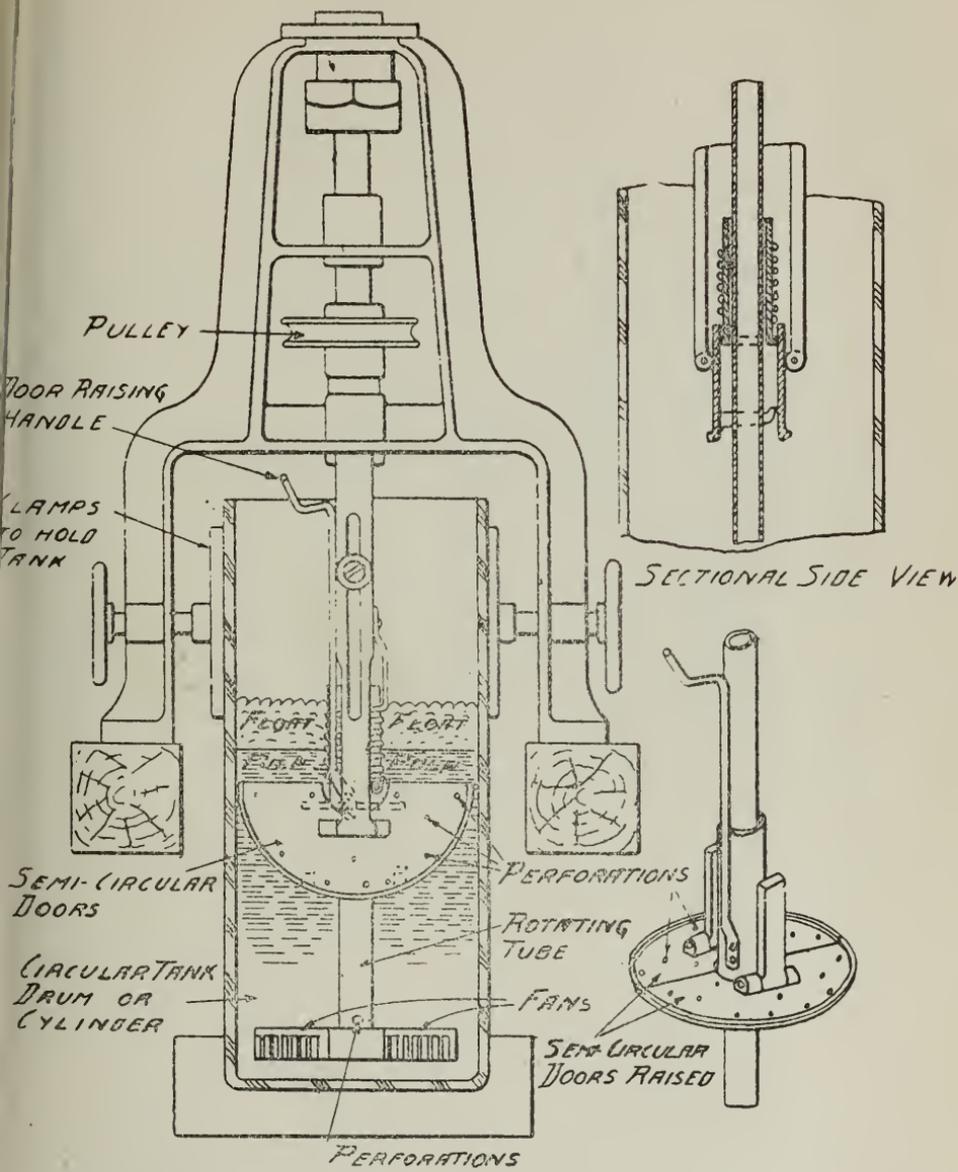
Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.

[Wt. 35—50/7/1914.]

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 217.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.

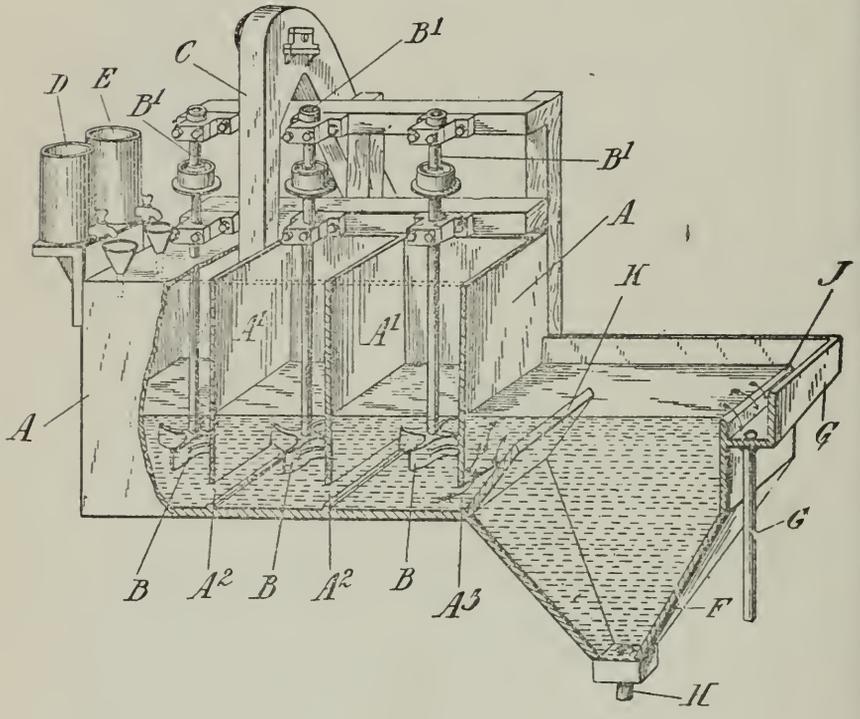
H: L. SULMAN, H. H. GREENWAY & A. H. HIGGINS.

ORE CONCENTRATION.

APPLICATION FILED APR. 30, 1908.

962,678.

Patented June 28, 1910



Witnesses
 J. M. Shynkoop,
 613 Melton

Inventors,
 Henry Livingston Sulman,
 Henry Howard Greenway and
 Arthur Howard Higgins
 By
 Knight Bros
 Attorneys.

LIVINGSTONE SULMAN, HENRY HOWARD GREENWAY, AND ARTHUR HOWARD HIGGINS OF LONDON ENGLAND.

ORE CONCENTRATION

Specification of Letters Patent. **Patented June 28, 1910.**

Application filed April 30, 1909. Serial No. 493,207

From it may concern.
 known that we, HENRY LIVINGSTONE
 HENRY HOWARD GREENWAY, and
 HOWARD HIGGINS, subjects of the
 England, residing at London, Eng-
 have invented certain new and useful
 ements in Ore Concentration of
 the following is a specification.

The invention relates to the concentra-
 ores, the object being to separate cer-
 constituents of an ore such as metallic
 from other constituents such as
 when the ore is suspended in a liquid
 water.

According to this invention the crushed
 mixed with water containing in solu-
 small percentage of a mineral-froth-
 agent, (that is of one or more organic
 substances which enable metallic sulfids to
 under conditions hereinafter specified)
 containing also a small percentage of a
 acid such as sulfuric acid, and the
 is thoroughly agitated; a gas is
 fed in, generated in, or effectively in-
 troduced into the mixture and the ore par-
 ticles come in contact with the gas and the
 result is that metallic sulfid particles float
 on the surface in the form of a froth or
 scum and can thereafter be separated by
 well known means. Among the or-
 ganic substances which in solution we have
 found suitable for use as mineral-frothing
 agents with certain ores are amylic acetate
 and other esters; phenol and its homologues;
 valeric and lactic acids; ace-
 tones and other ketones such as camphor.
 In some cases a mixture of two such min-
 eral-frothing agents gives a better result
 than a single agent. The above mentioned
 mineral-frothing agents are all more or less
 soluble in the presence of an acid such as
 sulfuric acid and are given as types but are
 not intended to form an exhaustive list of
 suitable organic substances which may be
 used in this manner and for these objects.
 On the other hand there are many organic
 substances which in solution will not effect
 the result described, such as some sugars,
 albumin, soap, albumen, ox gall, etc., and
 a simple test is required in the case of vary-
 ing ores or materials to determine which
 compound is most suitable.

The following is an example of one method
 of carrying this invention into effect:—

Water containing a small percentage of sul- 55
 furic acid in solution, say from 2% to
 0.5%, and containing in solution a small
 quantity say 0.1% of one of the foregoing
 organic substances (say amylic acetate) is,
 with finely pulverized ore, introduced into 60
 an agitating apparatus, in the proportion
 of say 3 parts by weight of water to 1 part
 by weight of ore. The agitation is carried
 out in such a way as thoroughly to dis-
 seminate air through the mixture which is 65
 thereafter discharged into a spitzkasten.
 It is found that a coherent froth or scum
 floats on the surface of the water in the
 spitzkasten. This froth contains a large 70
 proportion of the metallic sulfids but is sub-
 stantially free from gangue. Any well
 known means may be employed for collect-
 ing the froth. If desired the tailings can
 be re-treated by the same process with or 75
 without the addition of fresh quantities of
 the organic materials referred to. The ac-
 tion may in some instances be improved by
 heating the mixture.

The accompanying drawing is a diagram-
 matic view in perspective illustrating one 80
 form of apparatus partly broken away suit-
 able for use in this process. (The apparatus
 itself forms no part of this invention.)

Several agitation vessels A are placed in
 series. These may conveniently be large vats 85
 separated by partitions A¹ having openings
 A² at the bottom so that the liquid may pass
 from one to another. Each vessel is pro-
 vided with a rotatable stirrer B which is
 conveniently of the form shown in the draw- 90
 ing. Each stirrer is carried on a spindle B¹
 rotated at a high speed by any convenient
 means. Crushed ore or similar finely divided
 mineral is fed into the first vessel A through
 any convenient ore-feeding device such as 95
 C, and water is also fed into the vessel A.
 A small proportion of acid, such as sulfuric
 acid, may be introduced into the water from
 the feeding vessel D, and a small proportion 100
 of one or more other soluble substances
 which enable metallic sulfids to be floated by
 air under the conditions hereafter specified
 may be introduced from the feeding vessel 105
 E. The liquid containing ore in suspension
 is vigorously agitated in the agitation-ves-
 sels and escapes at the outlet A³ highly
 charged with air.

A settling apparatus consisting of one or

more spitzkasten F. is placed immediately at the outlet from the agitation apparatus. As shown in the drawing, the spitzkasten F has a launder G to receive the floating froth which passes away through the outlet G'. The liquid and the sunken material pass out through the outlet H at the bottom of the spitzkasten. The level of the liquid in the spitzkasten is slightly above the lip J. Within the spitzkasten is placed an inclined baffle or guide-plate K, which may be made adjustable, extending upward from below the inlet A^s and arranged to direct the stream of ore-particles and air-bubbles toward the surface of the liquid in the spitzkasten.

Hitherto many proposals have been made for the wet concentration of ores involving the addition to the liquid in which the ore is suspended of an immiscible liquid. For example in the patent granted to Cattermole, Sulman & Picard, United States No. 777274 dated December 13th, 1904, is described a process of ore concentration in which metalliferous particles were coated with a thin film of a fatty or resin acid or a phenol or a cresol by introducing the alkaline compounds of these materials into an acid liquid whereby these materials were liberated in an immiscible or insoluble condition and adhered to the mineral particles. In another known process the powdered ore suspended in water, preferably acidified, is mechanically brought to the surface whereby the particles are exposed to the air and it is found that the metalliferous particles float on the surface while the gangue sinks. In this known process the selective flotation of the metalliferous particles is not due to the metalliferous particles being coated with a selective agent, that is to say, the selective flotation is due to the properties of the metalliferous particles themselves when exposed to air or other gas and brought onto the edge or surface of water preferably acidified.

The present process differs from the two before mentioned types and from other known concentration processes by the introduction into the acidified ore pulp of a small quantity of a mineral-frothing agent *i. e.*, an organic compound in solution of the kind above referred to and by the fact that the metalliferous particles are brought to the surface in the form of a froth or scum not by mechanical means but by the attachment of air or other gas bubbles thereto.

In the frothing processes hitherto known the substances used to secure the formation of a mineral-bearing froth has been oil or an oily liquid immiscible with water. According to this invention the mineral-frothing agent consists of an organic compound contained in solution in the acidified water.

We do not confine ourselves to the pro-

portions above given, the best proportions can in each case be easily determined.

It is well known that certain organic substances we have referred to soluble in water in all proportions if used in excess might partly remain insoluble in the acidified water and become mechanically affixed to the minute particles of the ore. We disclose such use of these substances and others in such amount as will enable to dissolve in the acidified water.

What we claim as our invention and desire to secure by Letters Patent is:

1. The hereindescribed process of concentrating ores which consists in mixing powdered ore with water containing in solution a small quantity of a mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

2. The hereindescribed process of concentrating ores which consists in mixing powdered ore with water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

3. The hereindescribed process of concentrating ores which consists in mixing powdered ore with slightly acidified water containing in solution a small quantity of a mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

4. The hereindescribed process of concentrating ores which consists in mixing powdered ore with slightly acidified water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture to form a froth and separating the froth.

5. The hereindescribed process of concentrating ores which consists in mixing powdered ore with water containing in solution a small quantity of a mineral-frothing agent, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

6. The hereindescribed process of concentrating ores which consists in mixing powdered ore with water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

7. The hereindescribed process of concentrating ores which consists in mixing powdered ore with slightly acidified water containing in solution a small quantity of an organic mineral-frothing agent, agitating the mixture and beating air into it in a finely divided state so as to form a froth and separating the froth.

8. The hereindescribed process of concentrating ores which consists in mixing

powdered ore with slightly acidified water containing in solution a small quantity of an organic mineral-frothing agent, heating the mixture, agitating the mixture and beating it into it in a finely divided state so as to form a froth and separating the froth.

9. The hereindescribed process of concentrating ores which consists in mixing the powdered ore with slightly acidified water containing in solution a small quantity of an organic amyl compound, agitating the

mixture to form a froth and separating the froth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

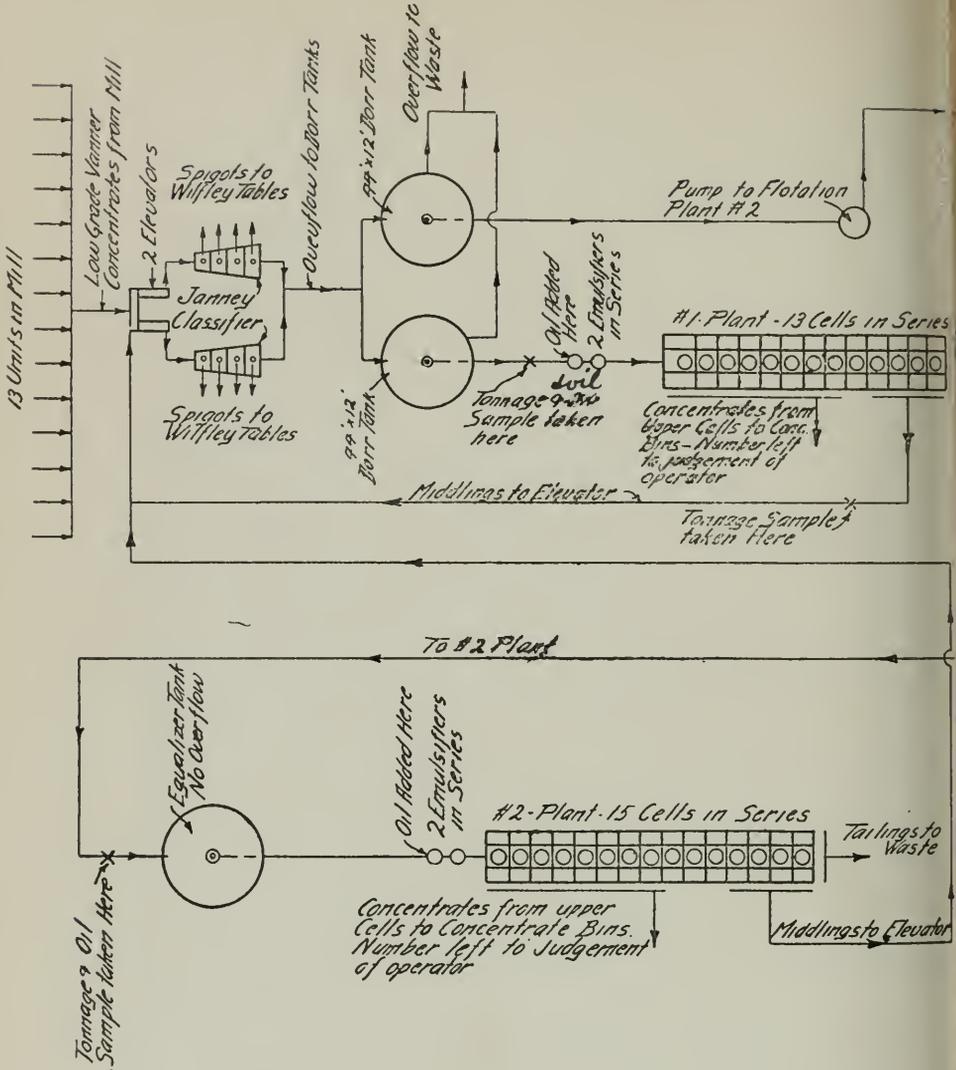
HENRY LIVINGSTONE SULMAN
E. HOWARD GREENWAY.
ARTHUR HOWARD HIGGINS.

Witnesses:

WALTER J. SKERTEN.,
E. C. WALKER.

Filed May 18, 1917. GEO. W. SPROULE, **Clerk**.
By H. H. WALKER, **Deputy**.

Defendant's Exhibit No. 219.



FLOW SHEET FOR CONCENTRATE FLOTATION PLANT
ARTHUR PLANT UTAH COPPER CO.

5-21-17

Defendant's Exhibit No. 220.

UTAH COPPER COMPANY—ARTHUR PLANT METALLURGICAL DEPARTMENT

Eight-hour test made in Retreatment Plant consisting of two Emulsifiers and thirteen Cells using 323.78 pounds of Oil per ton of low grade concentrate.

Test started April 29 at 5.45 P. M. and ended April 30, at 1.45 A. M.

RESULTS.

	Heading	Tailing	Concentrate
Tonnage	91.3	64.1	27.2
Per cent copper (Note a).....	5.25	.22	17.10
Per cent iron.....			16.00
Per cent insoluble.....			40.00
Pounds oil per ton by assay (Note b)	1.04	20.753	680.175
Pounds new oil per ton.....	322.74		
Total pounds oil per ton.....	323.78		
Total pounds oil used.....	29,560.95		
Total pounds of oil computed from assays	94.95	1330.27	18,500.76
Ratio of concentration.....	3.356 into 1		
Per cent indicated copper ex- traction	97.058		
Per cent solids in feed.....	18.03		
Pounds alkaline reagent per ton..	6.37		

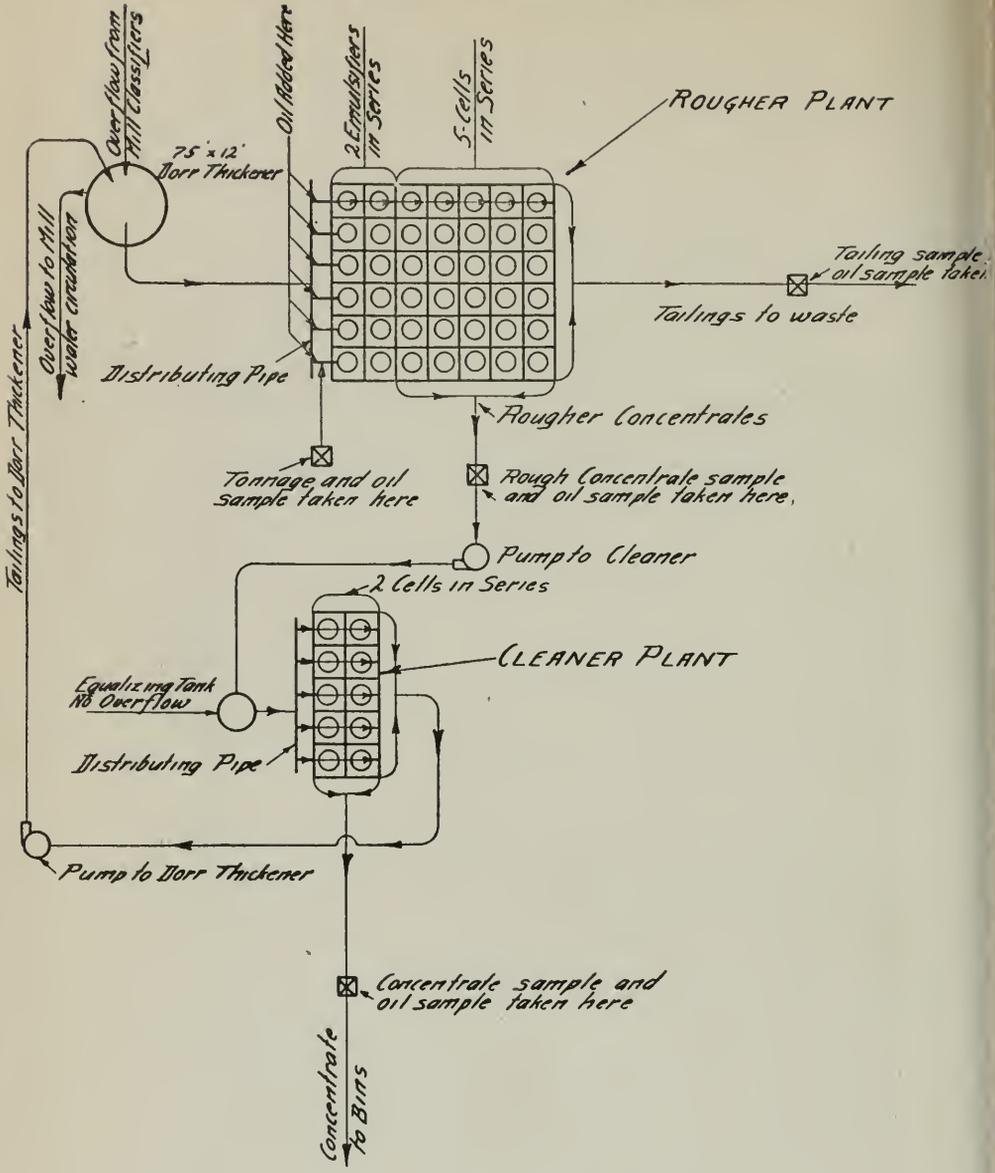
Kind of oil used—a mixture composed of 59% Fuel Oil, 30% Jones Oil, 10% American Creosote No. 2, and 1% Yaryan Pine Oil.

(a) On account of the products containing so much oil they were washed with an oil solvent before the metal assays were made.

(b) These figures represent the amount of oil per ton of original material treated and the resultant products.

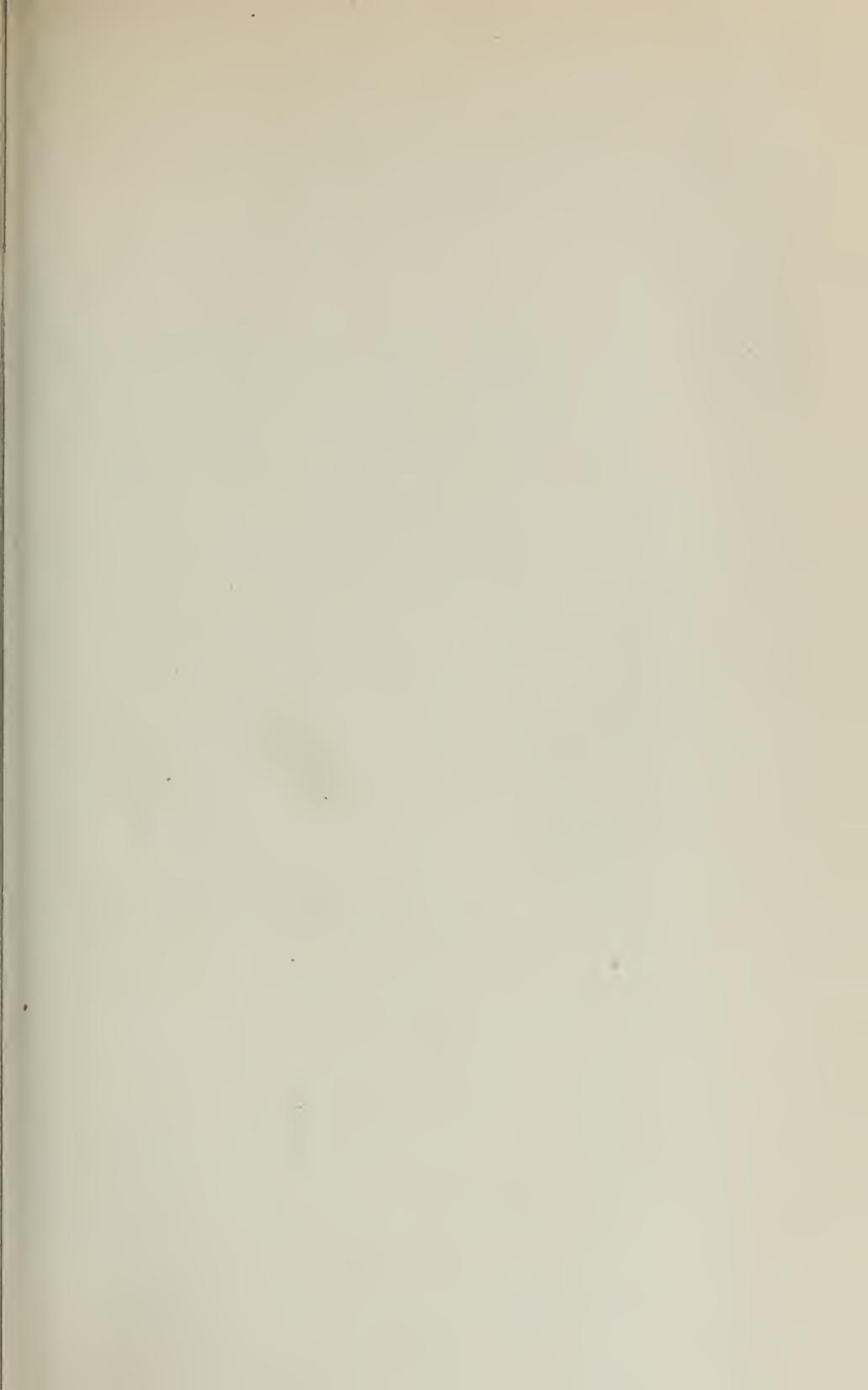
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 221.

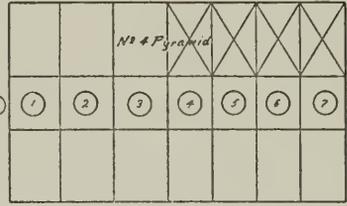
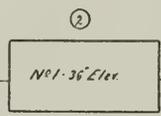
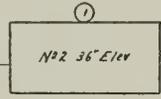
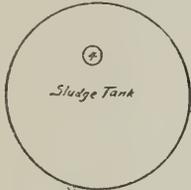


FLOW SHEET FOR SLIME FLOTATION PLANT
ARTHUR PLANT UTAH COPPER CO.

9-21-17



Slimes and Tube Mill Product
to 60' Ford

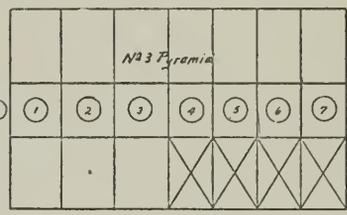


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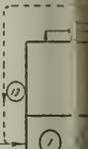
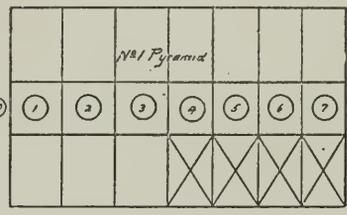
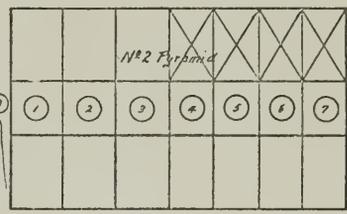
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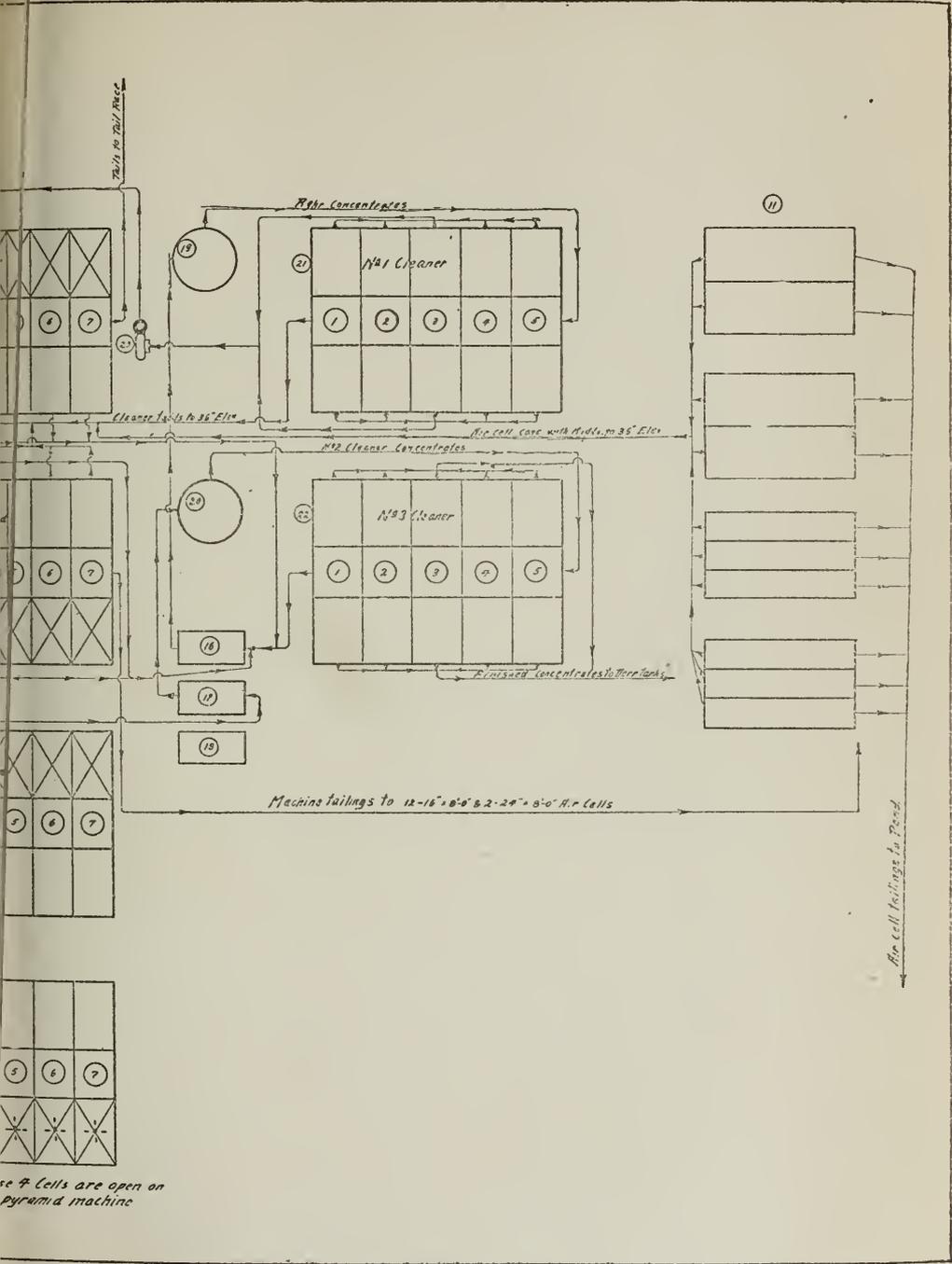


Slimes T.M. Product & Middlings

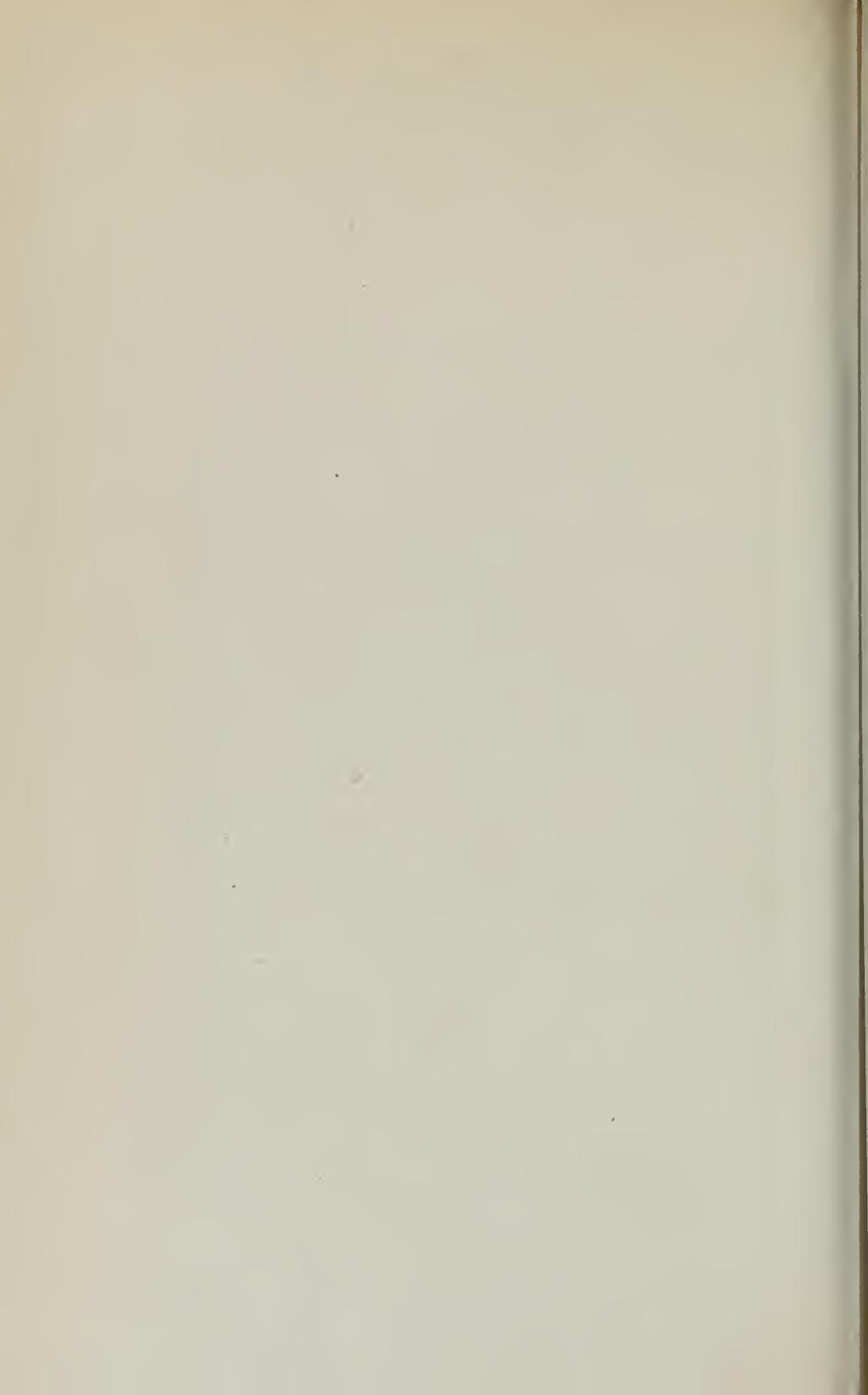


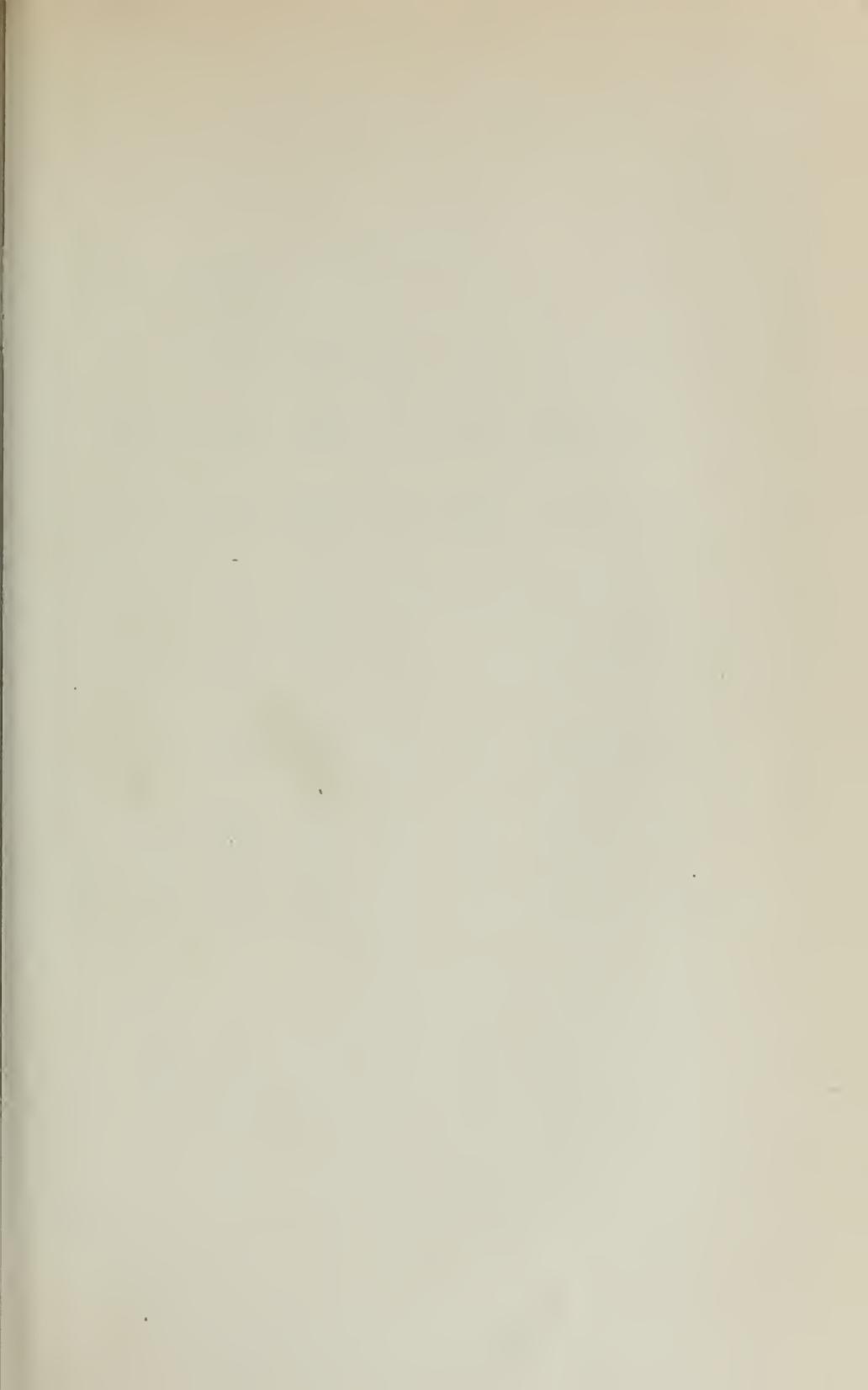
it o. 222.

DRIFLOTATION PLANT



Cells are open on pyramid machine





BUTTE &
FLOTATION PLANT OPER

DATE	H ² SO ⁴	REAGENTS USED			Lbs. per Ton Oil in Concts. & Tails	PER CENT OF	
		Lbs. per Ton of Flotation Feed				Heads & Middling Return	Concts.
		CuSO ⁴	Metallic Copper	Initial Oil			
Feb. 1....	8.07	5.17	.062	10.77	11.00	.64	1.45
Feb. 2....	7.17	5.99	.072	13.94	11.40	.70	1.34
Feb. 3....	9.20	6.96	.098	17.78	13.80	.73	1.36
Feb. 4....	8.37	5.23	.063	19.83	11.00	.74	1.12
Feb. 5....	8.61	5.92	.071	20.99	12.20	.79	1.12
Feb. 6....	12.69	5.64	.068	24.31	15.20	.78	1.04
Feb. 7....	7.83	5.65	.068	19.03	13.40	.76	1.34
Feb. 8....	10.73	5.40	.065	16.86	13.00	.79	1.10
Feb. 9....	9.45	5.81	.070	19.65	13.00	.75	1.53
Feb. 10....	11.36	8.20	.098	20.75	18.20	1.08	2.10
Feb. 11....	7.69	5.11	.061	15.34	12.00	.85	1.59
Feb. 12....	10.81	6.70	.080	16.24	18.40	1.14	2.31
Feb. 13....	11.60	6.63	.079	19.62	20.80	1.36	2.66
Feb. 14....	18.40	7.02	0.84	13.93	17.20	1.12	2.49
Feb. 15....	7.31	6.27	.075	16.57	16.00	.99	2.24
Feb. 16....	11.57	8.53	.124	24.86	16.40	1.27	1.94
Feb. 17....	10.43	8.92	.130	22.05	19.60	1.24	1.95
Feb. 18....	10.49	8.00	.116	21.80	18.80	1.74	1.94
Feb. 19....	10.65	11.00	.153	21.40	19.40	2.02	2.02
Feb. 20....	9.62	10.45	.153	21.56	18.80	2.51	1.93
Feb. 21....	7.84	5.37	.074	17.69	18.80	1.24	1.87
Feb. 22....	10.92	7.64	.100	20.22	18.80	2.85	2.29
Feb. 23....	11.71	4.31	.064	14.97	21.20	1.35	2.47
Feb. 24....	11.76	7.59	.097	24.13	17.40	1.05	2.08
Feb. 25....	9.77	7.59	.097	22.41	15.80	1.13	1.66
Feb. 26....	9.60	5.73	.079	24.17	16.20	1.17	1.69
Feb. 27....	10.47	8.00	.109	20.85	19.40	1.14	1.61
Feb. 28....	7.74	6.84	.094	19.30	20.60	1.26	1.90

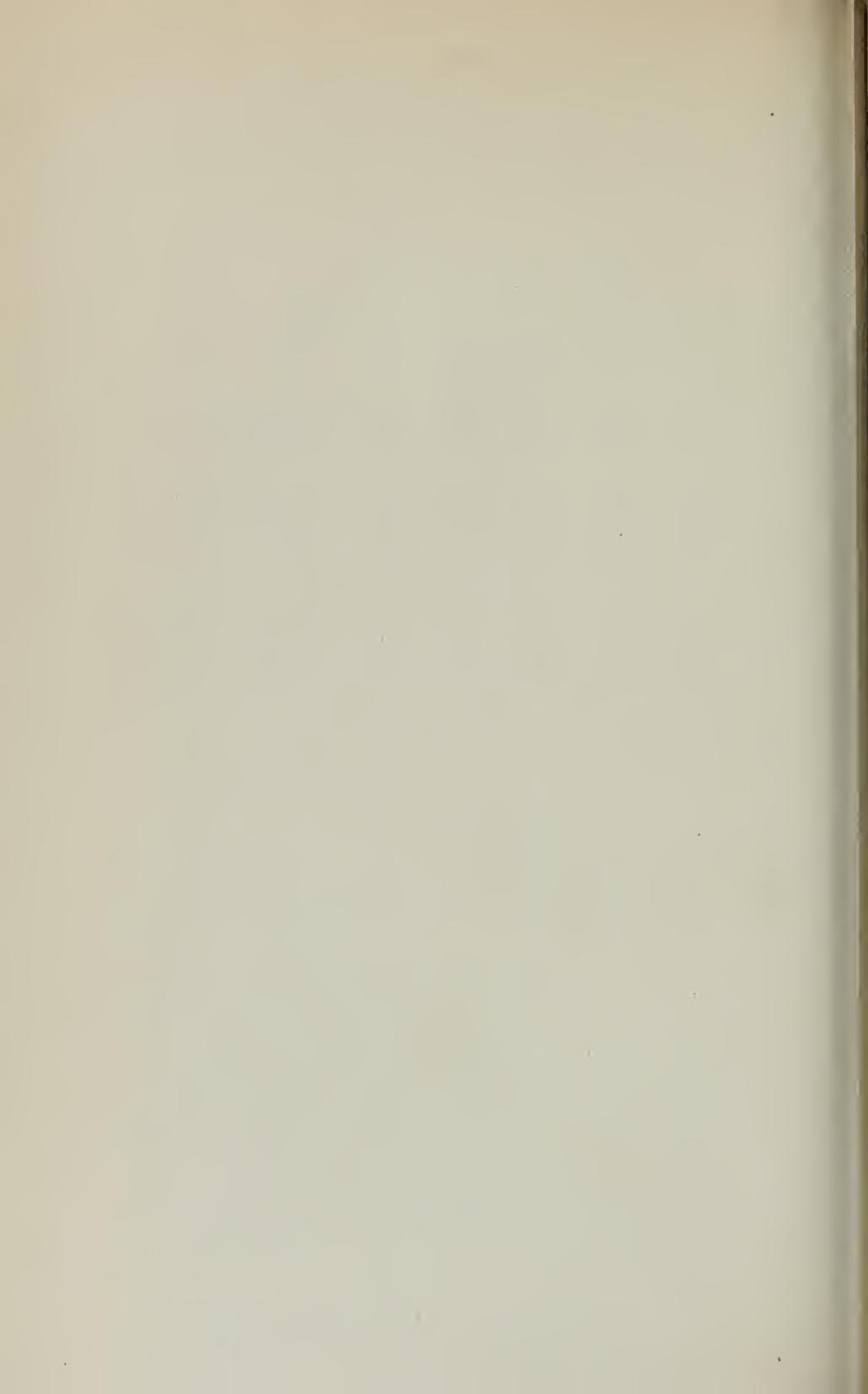
Butte, Montana,
April 21, 1917.

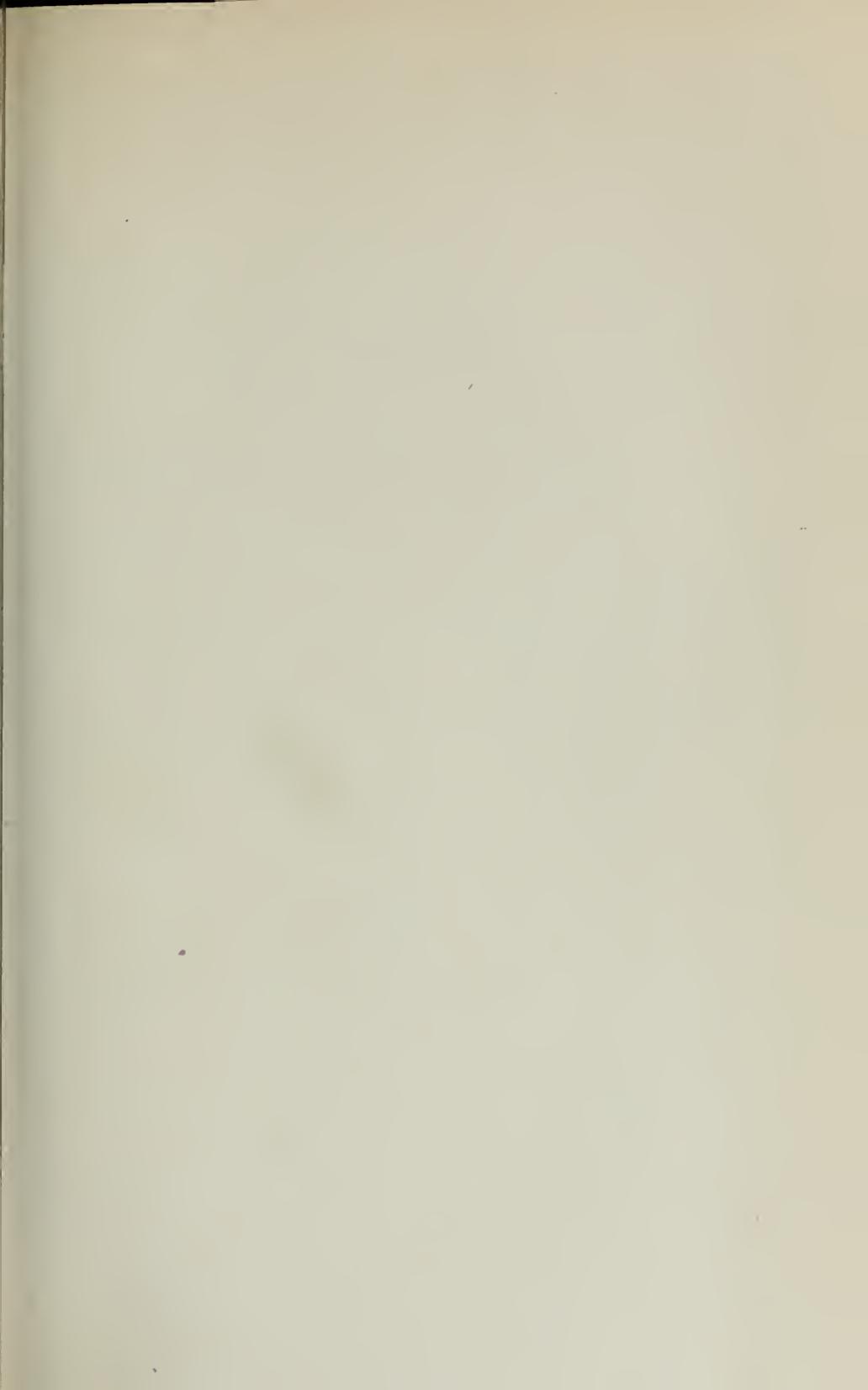
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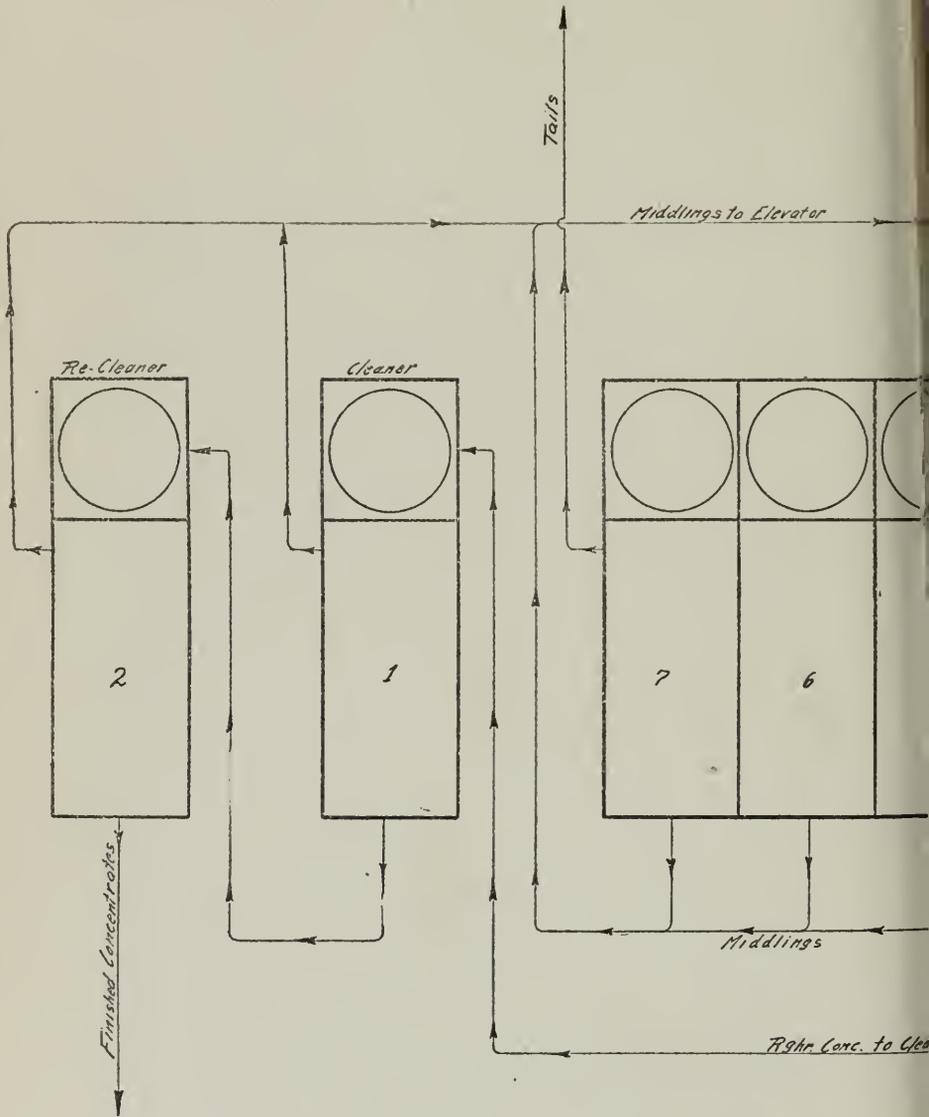
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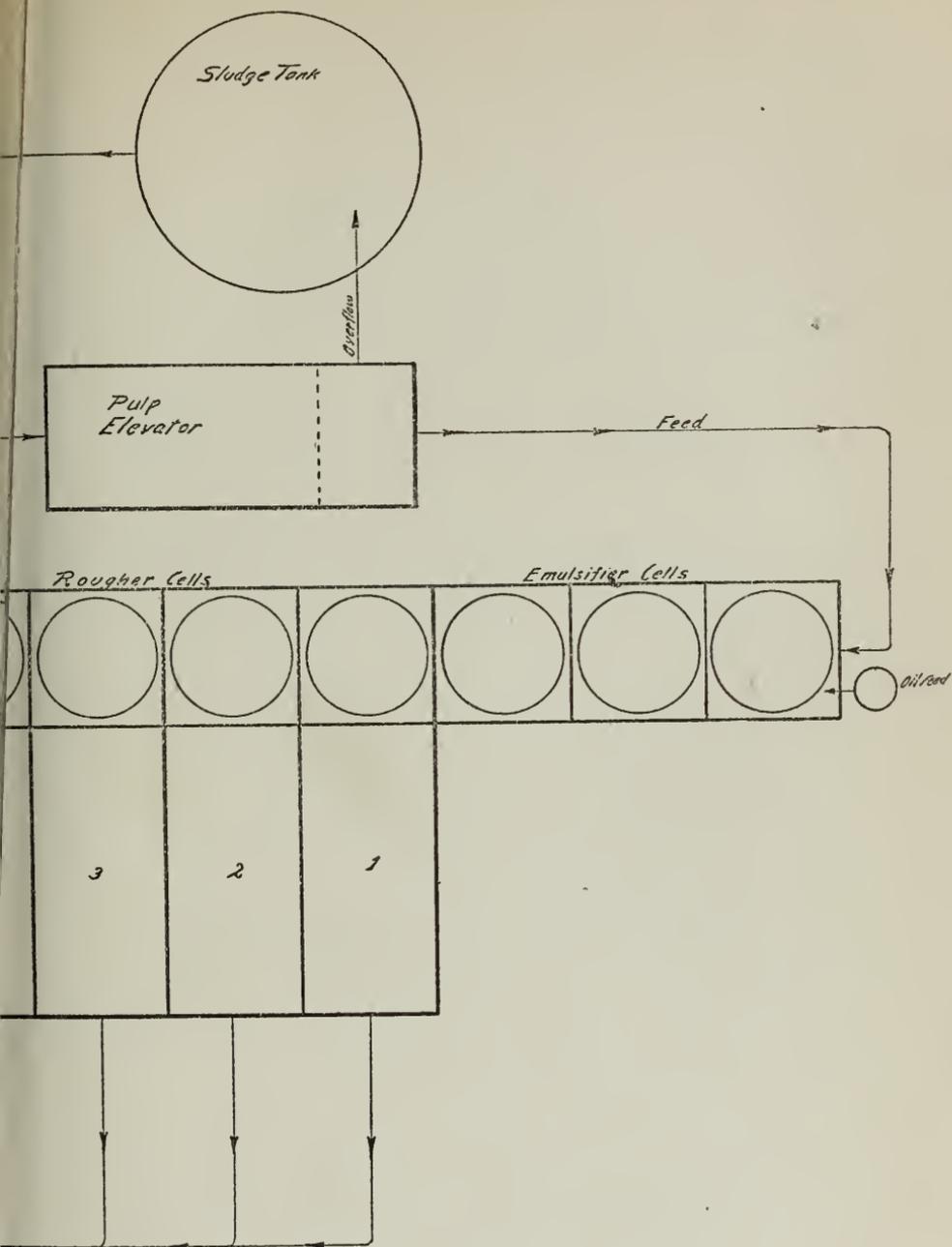
MONTH OF FEBRUARY, 1917.

ZINC		Dilution of Feed	Temperature of Feed Deg. C.	REMARKS
Tailings				
	1.41	2.2 to 1	29	Good run
	1.13	3.3 to 1	29	Good run
	2.42	3.3 to 1	26	High tailings due to poor operation on No. 1 Rougher
	2.12	2.4 to 1	20	Machines handling too coarse feed
	2.04	2.7 to 1	34	Feed still too coarse for good results
	2.12	2.6 to 1	24	Several changes in reagents caused a rather erratic and unsettled condition throughout the plant
	2.06	2.9 to 1	19	Elevators going in pit off and on all day
	3.40	2.6 to 1	19	Elevators still giving considerable trouble
	2.76	2.6 to 1	21	Considerable trouble with frozen oil lines, causing many changes in reagents, hence poor operative results
	2.24	2.4 to 1	27	Conditions on this day same as that of previous day
	1.81	2.9 to 1	24	Mill down first two shifts account lack of ore
	2.60	2.7 to 1	25	Elevators in Pit most of day. All feeds cut off for 2½ hours on this account
	3.80	2.1 to 1	24	Conditions in plant unsettled due to overfeeding machines and more or less elevator trouble
	1.96	2.4 to 1	28	Good run
	2.90	1.8 to 1	28	Rougher Concts. direct to bins, account mechanical difficulties on cleaners and recleaners
	1.49	1.9 to 1	21	Fair run
	1.67	2.8 to 1	18	Fair run
	1.10	1.4 to 1	21	Fair run
	.92	2.2 to 1	21	Fair run
	.90	2.6 to 1	23	Fair run
	.99	2.0 to 1	24	Very good run considering the fact that the machines were handling an extra large tonnage
	2.19	2.2 to 1	21	Elevators giving considerable trouble Middling return cut down to lighten load to elevators
	2.24	2.3 to 1	18	Changed reagents several times during day which caused confusion in entire plant
	2.10	2.4 to 1	20	Same trouble as day previous
	1.01	2.8 to 1	16	Cleaner and recleaner cells out of order
	1.19	2.5 to 1	16	Cleaner and recleaner still out of order and elevators giving considerable trouble
	1.69	2.7 to 1	16	Trouble at concentrate bins caused considerable trouble in plant account shutting down and starting again
	2.50	2.2 to 1	14	Overfeeding machines and elevators. Unable to handle return feed

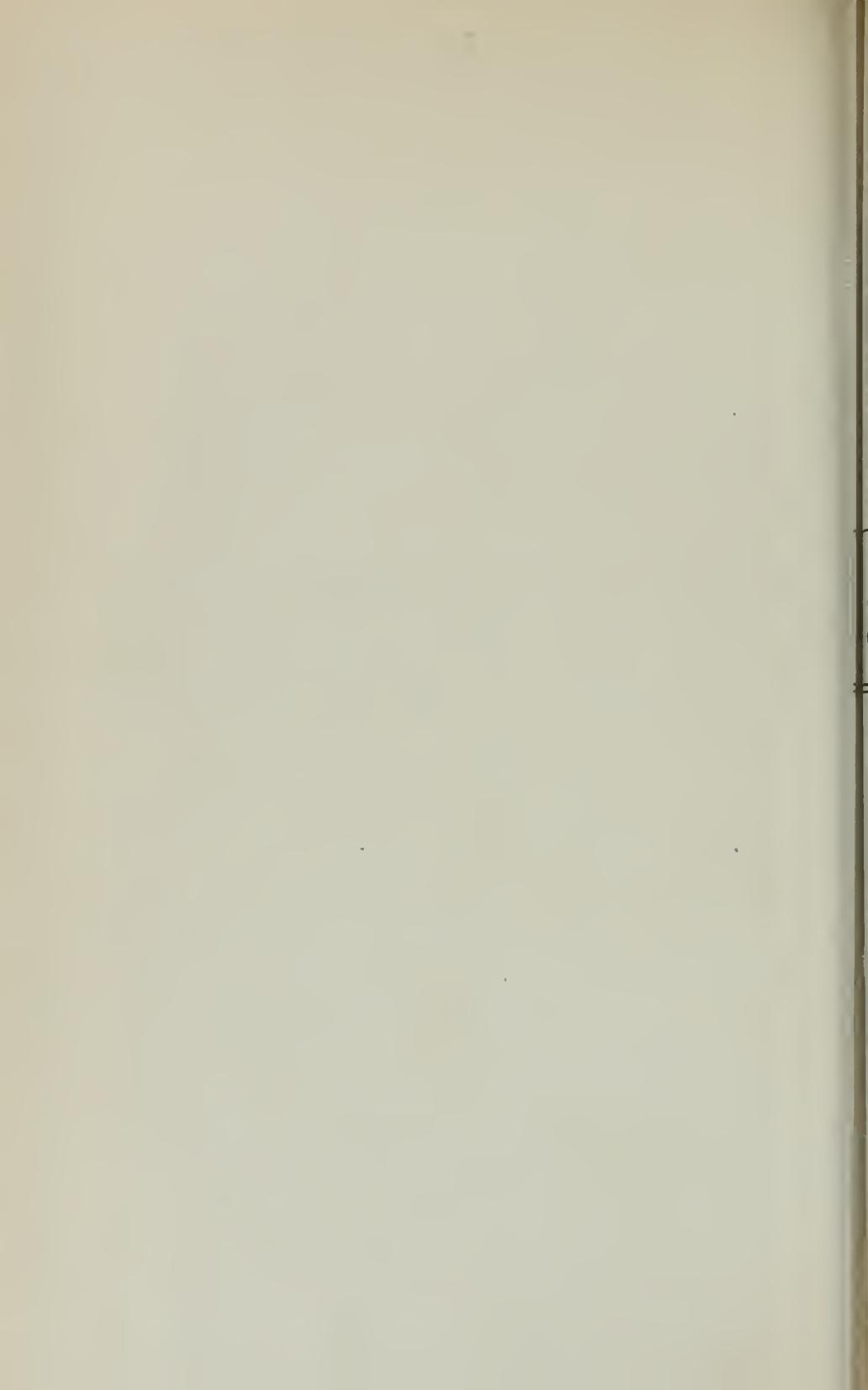




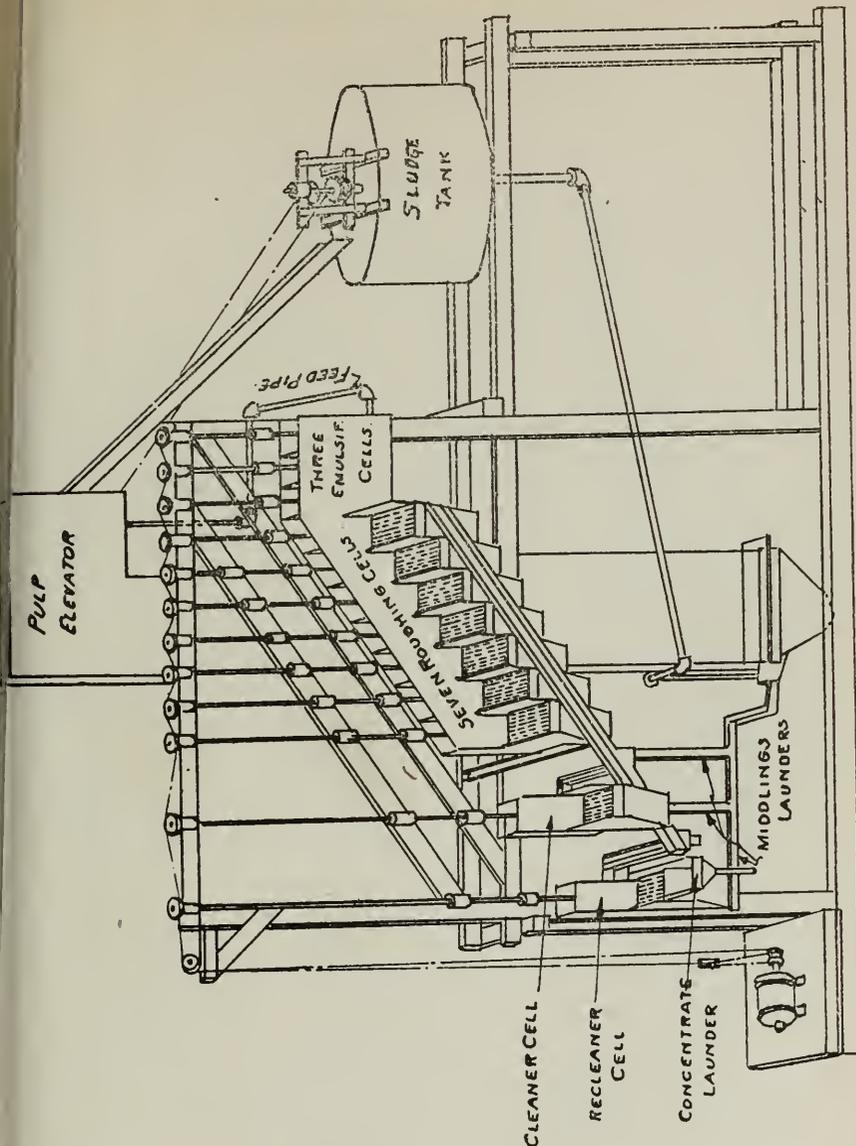




Filed August 23, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.



Defendant's Exhibit No. 225.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 226.

Butte & Superior seven-cell test machine—
Physical Exhibit

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 227.

Butte, Montana,
May 5th, 1917.

Mr. J. L. Bruce,
Manager,
Plant.

Dear Sir:—

Attached hereto tabulated sheets showing results of samples taken from 1:00 to 5:00 P. M., Sunday, April 29th at which time representatives of the Mineral Separation Company and representatives of the Butte & Superior Mining Company were present during the time all samples were taken, placed in containers, and marked, also copy of letter from Edward Walser, Chief Chemist, R. B. Stringfield, Oil Chemist and T. R. Featherly, Head Sampler, describing the manner in which all samples were handled. I was present during the entire period when the samples were taken.

Flotation Head, Flotation Concentrate and General Mill tailings samples were taken from the automatic samplers, cutting every $7\frac{1}{2}$ minutes. Alternating cuts were turned over to representatives of the Minerals Separation Company and page No. 3 is analyses of the the other alternating cuts retained by our representatives. Hand samples were taken of the first, second and third Spitz on the North side of the No. 5 Pyramid machine and the South side of the No. 6 Pyramid machine, which I consider fairly represents the Rougher concentrates. Samples were taken from the Nos. 4, 5, 6, and 7 Spitz of the same machines, which

Defendant's Exhibit No. 227

would fairly represent the middlings returned from the Roughing machines. These samples do not include the first and second cleaner tailings, which were also returned to the head of the machines as middlings. Grab samples were taken of the crude ore from the mine bin, the Mill Heads at the Tripper, the discharge product from Tube Mills Nos. 2 and 3, Section 2, and Spigot products from the 40' and 50' Settling tanks. The last two samples cannot be considered representative of regular operations as they were only grab samples. Sample of the Nos. 1, 2 and 3 cleaner tailings were also grab samples and cannot be considered representative of regular operations.

Yours very truly,

J. T. Shimmin,
Mill Superintendent.

JTS:JDS

Defendant's Exhibit No. 227

Sheet No. 1

BUTTE & SUPERIOR MINING COMPANY

Special Report of Flotation Operation 1:00 to 5:00 P. M., 4/29/17
OILS—

NAME	% of Total	Pounds per Min.	Lbs. for Four Hours	Specific Gravity †
Standard Yaryan Pine.....	24.30	7.035	1689	.9050
Fuel Oil	64.47	18.664	4479	.5860
Commercial Kerosene	11.23	3.251	780	.8195
Mixture	100.00	28.950	6948	.8821

OTHER REAGENTS—

NAME	cc's per Min.	Lbs. for Four Hours	Specific Gravity
Sulphuric Acid to Distributor.....	1497.8	1865	1.705
" " " Slimes.....	571.0		
Copper Sulphate to Distributor.....	2452.8	1712	1.321

Period of Operation.....Four hours
 Flotation feed tonnage for four hours.....263.53 dry tons
 Flotation concentrates produced.....60.16 dry tons
 Temperature of feed.....Atmospheric
 Dilution of feed.....3.45 :: 1

OILS AND REAGENTS USED

Pine Oil lb./Ton	Fuel Oil lb./Ton	Commercial Kerosene lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
6.41	17.00	2.96	7.08	(a) 6.50

(a) Equivalent to 0.10 pounds metallic copper per ton
 Metallic copper consumed.....26.022 pounds
 Actual initial oil added per ton.....26.37 "

The assay results and oil analyses for this period are as follows,

FLOTATION FEED INCLUDING

	CIRCULATING LEAD		TAILING		CONCENTRATE	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
1-5 P. M.....	12.6	1.77	1.57	0.67	45.2	3.13

Apparent Recovery—89.58% (Figured from theoretical flotation feed)

NOTE, † Specific Gravity of oil reagents was determined on the samples taken during this test.

Defendant's Exhibit No. 227

Sheet No. 3

BUTTE & SUPERIOR MINING COMPANY
 Special Samples—Flotation Operation—1:00 to 5:00 P. M. April 29th, 1917
 SAMPLE, ANALYSES, OIL AND DILUTIONS

NAME	ANALYSIS							Dilution	Taken By
	% Cu.	% Pb.	% Zn.	% Insol.	% Fe.	% Mn.	% Oil		
Flot. Feed No. 1 Bucket.....			11.15					4.0	
" " No. 2 ".....			12.1					3.5	
" " No. 3 ".....			12.3					3.7	
" " No. 4 ".....			13.5					2.5	J.W.L.
" " No. 5 ".....			13.5					3.6	C.K.B.
" " No. 6 ".....			13.2					3.6	
" " Composite.....	0.14	0.77	12.6	63.6	1.85	1.31		3.45	
Flot. Conc.—Finished Pro.....	0.57	3.35	45.2	19.0	2.78	0.40		3.0	C.F.W. J.W.D.
General Mill Tails No. 1 Bucket.....			1.40					3.0	W.A.B.W.
" " No. 2 ".....			1.71					3.3	C.C.R.
" " No. 3 ".....			1.76					3.5	H.J.S.
" " Composite.....	0.053	0.10	1.57	90.0	0.70	1.47		3.26	
Rougher Conc. 1st Spitz.....		3.55	35.2	32.0	2.89	0.76		4.1	
" " 2nd ".....		2.70	35.4	33.2	2.89	0.70		3.6	
" " 3rd ".....		2.45	37.7	29.2	3.44	0.70		3.4	
Primary Midds—4-7 Spitz.....		0.45	10.8	73.6	2.02	1.31		6.0	Wilding
Tails.....		0.10	1.16	91.8	0.55	1.53		2.3	J.W.S.
1st Cleaner Tails.....			16.70					6.4	G.A.C.
2nd ".....			8.65					8.2	A.W.H.
3rd ".....			12.35					10.4	
Slime Feed to Sludge Tank.....			13.6	70.4	1.36	1.36		2.4	
No. 4 Sec. 1 No. 1 Sec. 2—T. M. Dischg.....	0.14	0.88	8.9	80.6	1.36	1.20		0.7	J.L.G.
Crude Ore taken from Bins.....	0.43	0.60	22.3	59.2	2.29	0.35		—	T.F.
Crude Ore taken from Tripper.....	0.23	1.13	16.1	67.0	2.18	0.94		—	

Defendant's Exhibit No. 227

Special Samples—Flotation Operation—1:00 to 5:00 P. M., 4/29/17
 Samples Taken 4/29/17—1:00 to 5:00 P. M.

BUTTE & SUPERIOR MINING COMPANY

SAMPLERS

Name of Sample	M. S. Co.	B. & S. Co	Remarks
General Mill Tailings	Walling	Riser Stibel	3 buckets each party automatic sampler—7½ min.
Flotation Head Sample	Littleford	Bain	6 buckets each party automatic sampler—7½ min.
Flotation Concentrates	C. F. Williams	Dudgeon Hunter	1 bucket each party automatic sampler—7½ min.
No. 1 Spitz Rghr. Conc.	Wilding	Sheedy	Hand samples every 30 minutes
No. 2 " " " Conc. S. Side No. 6	Pudan	Burns	
No. 3 " " " " N. Side No. 5			
No. 4-7 " Midds.			
Tails No. 5 Pyramid only			

SPECIAL SAMPLES

1st Cleaner Tails 3:10 P.M.	Chapman	Hackwood	Grab sample—1 acid bottle
2nd " " 3:15 P.M.			" " —1 " "
3rd " " 3:20 P.M.			" " —1 " "
No. 4 Tube Mill Sec. 1, No. 1 Tube Mill Sec. 2—Discharge	Greniger	Featherly	Grab sample—1 acid bottle
Slime Feed to Sludge Tank			" " —1 " "
Crude Ore Sample from Tripper			" " —Approx. 12 lbs.
Crude Ore sample from Bins			" " —" " "
Cu SO4 & H2SO4 to Dist.	Martin	Engleman	Measured every 15 minutes
Oils	Williams	Conrad Cornelius	125 c.c. taken for sample each time
			Measured every 15 minutes
Individual Oils	Schultz	Hollister	250 c.c. taken for sample each time
H2 SO4 to Slimes	Wilkinson	Lewis	Sampled from 3:00 P.M. to 5:00 P.M.

BUTTE & SUPERIOR MINING COMPANY

Special Samples—Flotation Operation 1:00 to 5:00 P. M., 4/29/17

General Method of Treating Samples After Arriving at the Sampling Department

FOR OIL:—Samples consisting of more than one bucket:

1 cup from each bucket for separate oil analysis

1 cup from each bucket for composite oil analysis

Samples consisting of one bucket, one cup was taken for oil analysis

Samples which had been put in an acid bottle were transferred to a bucket and one cup taken for oil analysis

DILUTION:—All samples excepting the crude ore from the tripper and the mill bins were weighed before and after drying

FOR ASSAY:—Samples consisting of more than one bucket:

Dried contents of each bucket cut in halves

One set of halves were combined for a composite sample

Other set of halves assayed separately

Samples consisting of one bucket:

Assay sample cut out

REJECTS:—All rejects saved and sacked

JDS

.....
Mill Superintendent.

Defendant's Exhibit No. 227.

May 1st, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

On April 29th, 1917, representatives of the Mineral Separation Company Ltd., visited the Butte & Superior Mining Company's mill to take samples of various products in the flotation plant, and mill in general if so desired, and also to inspect the plant in general.

One or more of these visitors were escorted through the plant by a representative of the Butte & Superior Mining Company.

Samples were taken for a period of four hours, between the hours of 1:00 and 5:00 P. M. The flotation feed, concentrates and general mill tailings were taken by the automatic sampler, which cuts a sample every seven and one-half minutes. The primary tailings, middlings and rougher concentrates were taken by hand, every fifteen minutes.

Oil samples were taken of the plant mixture that was being used during the period of sampling to ascertain the amount of oil being used. A measurement was taken every fifteen minutes, which was weighed out. Copper sulphate solution and sulphuric acid was sampled every fifteen minutes but was measured in cc's per minute.

Special samples were taken on the first, second and third cleaner tailings. But one sample was taken of these products and placed in acid bottles.

Defendant's Exhibit No. 227.

Special samples were also taken of the slime feed to the sludge tank, discharge of No. 4 tube mill section 1, and No. 1 tube mill section 2.

A sample of mill feed was taken at the mill bins, on the tripper, and which was also taken by hand, and placed in a bottle. A sample of rock was taken from the mine bin, which was listed as a grab sample.

A representative of both companies was present at all times where samples were being taken. All samples were taken in duplicate, alternating cuts for each side so that both samples would be fair and representative.

At the close of the set time for sampling, all samples were turned into the sampling department, where the following method was used in drying and cutting down.

In every case where more than one bucket composed a sample each bucket was weighed and dried and a sample cut out for assay. Before being weighed an oil sample was taken. Each bucket sample was cut in half so a composite could be made up and an assay of the composite obtained.

Screen analyses were run on rejects of samples and on the composite sample of the flotation feed and general tailings. Screens will be run for weight of material and zinc.

All results of assays, weights, dilutions, oil and screen analyses will be reported under separate cover.

Yours truly,

T. R. Featherly.

Defendant's Exhibit No. 227.

May 2nd, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

The following is the analytical procedure used in determining the percentages of oil in the various products from the test run made in co-operation with Minerals Separation representatives, Sunday April 29th, 1917, from 1:00 to 5:00 P. M. This procedure has been thoroughly tested in this laboratory and proven accurate for the oil mixtures used and conditions prevailing in this plant.

ANALYTICAL PROCEDURE

The wet sludge, as received from the sampling department, was thoroughly mixed and immediately thrown on wet filter paper contained in a Buchner funnel. Suction was then applied and the water thoroughly drained; the resulting production containing from 10 to 15% moisture.

This product was removed from the filter paper as completely as possible, well mixed with a spatula, and duplicate samples, approximately two grams of dry substance each, placed in small porcelain crucibles, which were placed in a dessicator over dry calcium chloride. The dessicator was then sealed and allowed to remain at a temperature of about 20° Centigrade for fifteen hours, without opening. This has been proven to be sufficient time to completely dry the samples; the residue being dry ore and oil.

Defendant's Exhibit No. 227.

These dry residues were transferred to tared alundum extraction thimbles, which were then accurately weighed, placed in Soxhlet extractors, and extracted with ether for one hour and fifteen minutes, thus removing all the oil present in the sample. The thimbles plus the oil-free ore were then removed, dried at about 40° Centigrade, cooled, and weighed; the loss in weight being considered as oil, and being calculated to percent in dry oil-free ore.

For example:—

Weight thimble plus ore plus oil (before extraction)	12.2970	gms.
Weight thimble plus ore (after extraction)	12.2720	
	<hr/>	
	.0250	gms.
Weight thimble plus ore (after extraction)	10.216	
Weight thimble empty	<hr/>	
	2.056	gms.
Weight dry ore		
Weight Oil .0250		
<hr/>	<hr/>	
	=	= 1.22% oil
Weight dry ore	2.056	

Very truly yours,

R. B. [^]Stingfield.

RBS/EGB

Copy to:—D. C. Jackling.
 H. B. McKelvie.
 J. L. Bruce.
 W. A. Scott.
 J. B. Kremer.
 J. T. Shimmin.
 B. H. Dosenbach.
 Chas. Bocking.



P. 5300, erase lines 16 and 17 and substitute :

“ Weight oil .....	.0250 gms.
Weight thimble plus ore (after extraction)	12.272 gms.

Defendant's Exhibit No. 227.

May 4th, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

Our regular methods have been employed in determining the various metals and other constituents in the samples taken during the test run made in conjunction with Minerals Separation experts on Sunday April 29th 1917, from 1:00 to 5:00 P. M.

Yours very truly,

Edw. Walser,
Chief Chemist.

EW/EGB

CC to:—D. C. Jackling.
N. B. MacKelvie.
J. L. Bruce.
C. Bocking.
W. A. Scott.
J. B. Kremer.
J. T. Shimmin.
B. H. Dosenbach.
Edw. Walser.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 228.**BUTTE & SUPERIOR MINING COMPANY**Data Compiled From Original Records of Flotation Plant Operations
Month of November, 1916.**FLOTATION PLANT FEED**

Date November	Lbs. H ₂ SO ₄ 66 Deg. B. Per Ton	Lbs. Cu. Per Ton
1	6.49	.12
2	5.84	.11
3	5.73	.11
4	5.84	.11
5	6.04	.11
6	5.94	.11
7	7.10	.13
8	7.28	.13
9	6.14	.11
10	5.88	.11
11	6.83	.12
12	8.66	.15
13	7.62	.13
14	6.55	.11
15	6.94	.12
16	6.42	.11
17	6.24	.11
18	6.41	.11
19	10.84	.20
20	6.02	.11
21	4.45	.11
22	4.84	.13
23	4.32	.11
24	4.27	.11
25	4.19	.11
26	5.04	.13
27	3.90	.10
28	4.07	.11
29	5.86	.12
30	4.86	.11

Compiled May 2, 1917.

J. T. SHIMMIN,
Mill Superintendent.Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 229.

In The
SUPREME COURT OF THE UNITED STATES

October Term, 1916

No. 46

MINERALS SEPARATION, LIMITED and MIN-
ERALS SEPARATION AMERICAN SYNDI-
CATE, LIMITED,

Petitioners and Complainants,
against

JAMES M. HYDE,
Respondent and Defendant.

ORAL ARGUMENTS AND ILLUSTRATIONS

Washington, D. C., Tuesday, October 1, 1916.

ARGUMENT OF MR. WILLIAM HOUSTON
KENYON IN REPLY FOR PETITION-
ERS-COMPLAINANTS

Mr. Kenyon: May it please the Court, the question at issue, and the only question is the question of invention. Did the step that our patentees took constitute invention? The court below said no; it was simply a matter of degree. Respondent's counsel here defends that proposition by saying that our result is attained not by the diminution in the amount of oil, but

Defendant's Exhibit No. 229.

by some trick of agitation, some novelty of agitation. I will address myself first to that latter proposition.

And the history of the birth of this invention is a complete answer to it. (Record pp. 446-448-451.)

If your Honors have not already marked those pages in the record, I will ask you to mark them; the whole of page 448, the whole of page 451, and, on page 445, the paragraph just below the middle, commencing "peripheral velocity of cone."

Contemporaneous documentary records, written within a few weeks of the birth of this invention—evidence of an extraordinary character of the birth of a most extraordinary invention. These inventors were working on the Cattermole process—which, as has been explained, agglutinates by oil in about three per cent. proportion the metal particles into bigger granules such that they sink against an upcurrent of water which carries the gangue up and away—the Cattermole process. They were experimenting with modifications of all the conditions of that process. Among them one line of investigation was as to the influence of changes of peripheral velocity. All sorts of variations, from 840 to 1,460, in the speed of the cone, were made, but the invention in issue was not born.

Another line of investigation was as to the influence of changes in the amount of oil (page 447, the seventh item). Out of that series of experiments (where the only change made from experiment to experiment was in the amount of oil—a gradual diminution in the amount of oil, all other things remaining the same) was born this invention.

Defendant's Exhibit No. 229.

And the record of it is right there on page 448 "Details of Experiments," the last column, "Remarks" "Float vastly increased"—tracing that back you see it was with three-tenths of one per cent. of oil; and just below "Float" again "vastly increased"—tracing that back it was with one-tenth of one per cent. of oil.

This float phenomenon appeared (page 451) when the oil had been reduced to about one-half of one per cent., said the inventors, after studying the process six weeks.

As the amount of oil was reduced granulation practically ceased at a range of about one-half of one per cent. of oil but a certain amount of black mineral froth was noticed. They were trying to send the values down, but they began to come up to the top.

Mr. Justice Day: Is that on page 451?

Mr. Kenyon: Page 451, the third paragraph.

"A certain amount of black mineral froth was, however, noticed as a result. On successively decreasing the amount of oleic acid below .5 per cent. (that is one-half of one per cent.) it was found that whereas granulation ceased there was a growth in the amount of mineral float-froth under those conditions, and that the production of such float froth appeared to reach a maximum when about .1% of oleic acid on mineral was used."

If that evidence is true it disposes of the contention that this phenomenon which has revolutionized ore

Defendant's Exhibit No. 229.

concentration the world over is to be explained as some trick of agitation.

Mr. Justice Day: How do we know that fact, that it has revolutionized ore concentration the world over?

Mr. Kenyon: How do we know it? This record shows that up to 1912 about \$9,000,000 worth of values had been taken out, in Australia and Sweden and Chile, from dump heaps that had been valueless theretofore, by this process. The testimony that was taken in 1915 before Judge Bradford shows what had happened in the intervening three years, as pointed out in his opinion, during which three years an astounding development occurred in this country.

Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence.

Mr. Kenyon: At about one-half of one per cent. of oil.

Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?

Mr. Kenyon: We were passing from the region of Cattermole, which was a distinct—

Mr. Justice McReynolds: I want to know when your invention came into existence.

Mr. Kenyon: This invention was not reached, I should say, from those figures, until about .5, that is, one-half of one per cent., of oil was reached.

Mr. Justice McReynolds: At one per cent. you had no invention?

Mr. Kenyon: No.

Defendant's Exhibit No. 229.

Mr. Justice McReynolds: At one-half of one per cent. you did have invention?

Mr. Kenyon: It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.

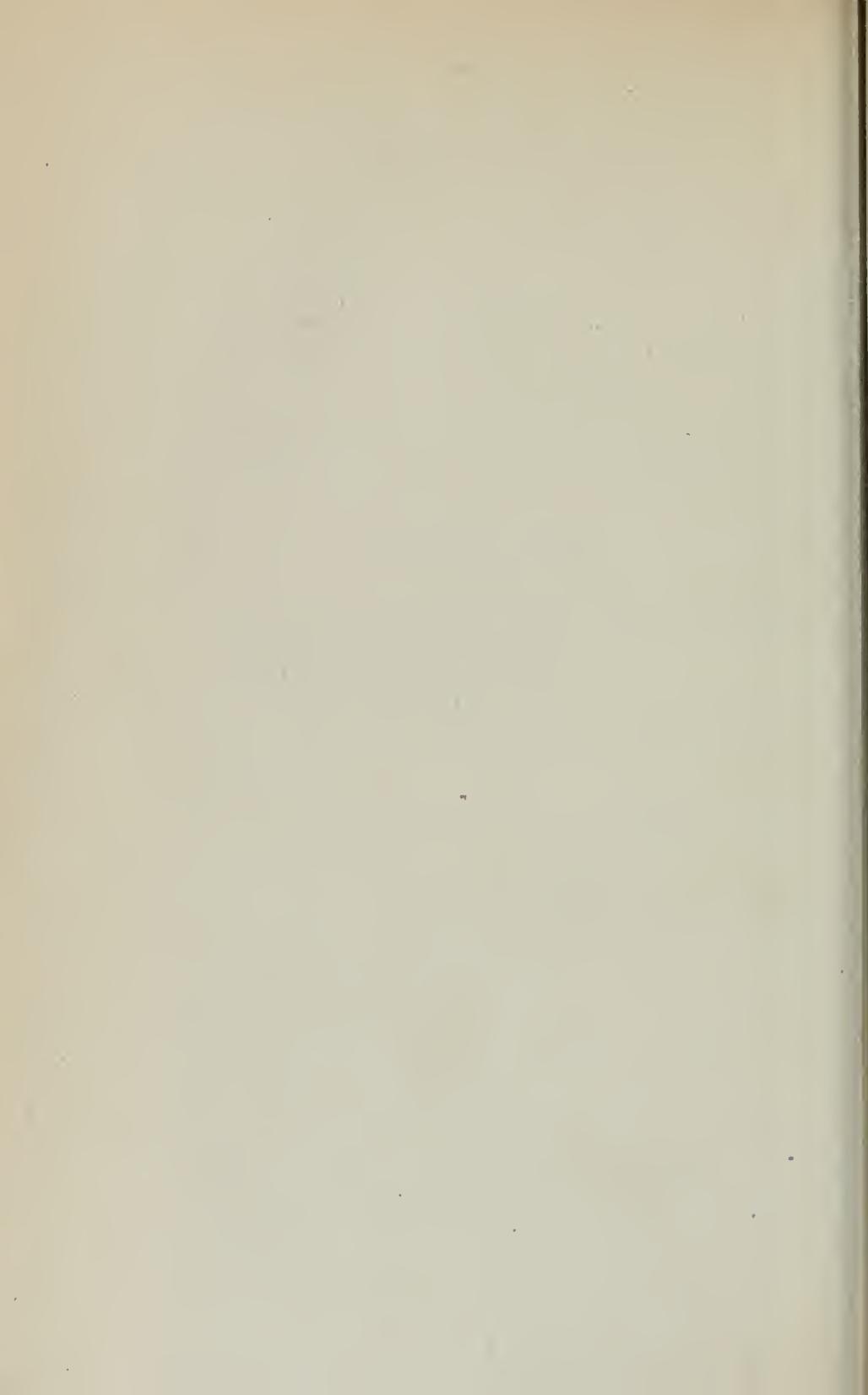
Mr. Justice McReynolds: When this float has more than one-half of one per cent. of oil it does not infringe?

Mr. Kenyon: It does not infringe.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.



Defend

CHI

Flotation Data for the Period
RETREAT

OILS USED									
DATE NOV.	Run	Kind	Lbs. per Ton	% Solids	Weight Tons	Tot. % Cu.	% Cu. Oxide	% Fe.	% Inso
1.....	24	B-J	8.06	46.43	420	3.60	.42	17.8	65.8
2.....	24	B-J-T	7.96	41.58	360	4.03	.39	13.1	74.8
3.....	24	B-J-Ch	12.09	39.31	330	5.87	.29	13.5	64.8
4.....	24	B-J	10.09	40.46	284	6.83	.19	11.1	70.1
5.....	24	B-J	6.97	40.42	318	5.00	.50	11.5	71.2
6.....	24	B-J	9.23	37.40	310	4.60	.24	15.3	64.8
7.....	24	B-J	10.04	36.71	282	5.43	.20	12.8	69.1
8.....	24	B-J	11.53	34.58	235	7.53	.18	9.2	75.4
9.....	24	B-J	10.06	37.31	248	6.03	.21	12.3	69.5
10.....	24	B-J	8.97	36.12	291	7.40	.36	12.1	70.4
11.....	24	B-J	6.15	37.86	334	8.30	.38	12.0	69.5
12.....	24	B-J	10.67	39.41	312	8.77	.41	9.1	72.3
13.....	24	B-J	9.05	40.23	375	8.37	.27	7.1	75.4
14.....	24	B-J	10.80	41.36	345	8.40	.17	10.2	69.6
15.....	24	B-J	12.22	38.25	270	8.23	.14	10.0	69.7
16.....	24	B-J	14.23	41.56	292	9.93	.20	16.0	59.0
17.....	24	B-J	15.46	41.83	280	10.23	.17	12.7	65.2
18.....	24	B-J	23.98	30.53	176	9.20	.24	10.7	68.1
19.....	24	B-J	20.61	32.10	206	12.03	.27	10.5	66.0
20.....	24	B-J	26.98	26.92	179	9.20	.20	9.6	70.7
21.....	24	B-J	17.68	36.64	244	9.63	.28	10.8	65.2
22.....	24	B-J	11.31	43.81	358	8.13	.39	20.0	54.5
23.....	24	B-J	11.81	40.64	326	5.50	.41	19.2	60.3
24.....	24	B-J	15.09	34.40	285	6.67	.17	15.1	64.4
25.....	24	B-J	26.14	28.32	184	7.83	.45	9.2	72.5
26.....	24	B-J	17.37	32.07	247	7.43	.25	14.1	65.7
27.....	24	B-J	17.85	33.59	221	8.40	.19	19.5	56.9
28.....	24	B-J	18.41	29.48	208	10.23	.11	11.4	66.8
29.....	24	B-J	15.51	36.52	254	10.30	.10	9.8	67.5
30.....	24	B-J	15.04	35.25	270	10.23	.25	11.1	65.3
Averages and totals..			13.71	37.03	8444	7.78	.27	12.6	67.3

NOTE—KINDS OF OIL USED—"B" signifies Barrett's No. 4 Creosol

NOTE—Reagents includes Na²S, Rosin and Caustic-Soda.
Dec. 10, 1916.
JDW

C:—F.G.J., W.H.J., J.M.S., F.R.W., FILE.

Copied at Butte, Mont., May 2, 1917.

Cost of
Cost of
Approx
Approx
Lbs. rea

b. 230.

ANY

November 30th, Inclusive, 1916.

CONCENTRATES

GS		CONCENTRATES				Ratio of Conct.	% Ind. Recov.	Lbs. Used of Re-agents
% Cu. Oxide	% Fe.	Weight Tons	Tot. % Cu.	% Fe.	% Insol.			
.13	13.4	105.76	13.37	26.6	33.1	3.99	93.13	1000
.13	10.4	72.43	18.97	23.3	34.0	4.97	94.65	1100
.08	10.9	96.77	19.43	21.4	30.3	3.41	97.11	1664
.07	7.5	82.32	23.13	23.1	24.7	3.45	98.23	915
.13	6.9	82.17	18.70	23.8	26.9	3.87	96.59	2464
.05	9.1	82.45	16.40	25.1	26.3	3.76	94.73	1697
0	10.4	75.60	19.70	25.9	24.4	3.73	97.17	1771
.01	5.6	66.20	26.43	21.0	26.5	3.55	98.76	978 ⁶
.02	13.5	58.08	24.53	22.2	22.7	4.27	95.17	924
0	20.4	82.44	25.70	20.4	29.9	3.53	98.45	1573
.04	11.6	94.90	28.87	19.0	30.9	3.53	98.45	1643
.10	10.9	89.66	29.73	16.8	28.5	3.48	97.40	1672
.04	6.2	88.24	34.60	13.9	27.4	4.25	97.17	922
.08	8.6	92.99	30.40	15.8	29.3	3.71	97.48	1565
0	7.9	84.91	25.40	19.2	28.2	3.18	96.92	1646
.08	15.5	115.41	24.83	17.4	33.5	2.53	98.66	1676
.05	12.5	89.46	31.63	17.2	26.1	3.13	98.67	883
.07	8.9	50.00	31.70	16.8	25.9	3.52	97.98	926
.07	8.9	70.79	34.50	14.8	26.2	2.91	98.42	1707
.05	5.4	69.11	23.60	17.0	33.7	2.59	98.86	923
.07	7.8	91.04	25.40	18.8	28.1	2.68	98.37	1586
.13	14.3	116.61	24.00	24.9	20.8	3.07	96.19	922
.10	16.0	91.83	18.60	29.0	21.5	3.55	95.17	1619
.11	12.4	93.75	18.63	27.4	23.5	3.04	91.95	839
.09	3.9	69.96	19.97	21.1	37.3	2.63	97.15	1576
.15	7.5	91.82	19.23	24.2	30.2	2.69	96.19	817
.08	11.6	105.74	16.77	33.5	22.5	2.09	95.34	1620
.06	4.8	98.11	21.40	21.7	34.4	2.12	98.50	909
0	4.7	101.60	25.23	17.1	37.9	2.50	98.14	853
.07	5.5	101.80	26.43	20.6	26.6	2.65	97.50	1625
.07	9.8	2611.95	23.91	21.3	28.4	3.16	97.19	40015

Turpentine; "CH" Chesapeake Pine.

Material treated.....	.3125
Material treated.....	.2086
Per month.....	\$2,638.98
Costs for month.....	1,762.21
Cost of material treated.....	4.74

(Signed) O. WISER,
Metallurgical Engineer.Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Defendant's Exhibit No. 231.

CHINO COPPER COMPANY
HURLEY PLANT

Rosin and Reagents Used in Vanner Concentrate Flotation Plant
During November, 1916.

DATE	Rosin Pounds	Sodium Sulphide Pounds	Caustic Soda Pounds	Total
1	270	700	30	1000
2	84	1000	16	1100
3	160	1474	30	1664
4	150	735	30	915
5	233	2184	47	2464
6	200	1457	40	1697
7	270	1451	50	1771
8	200	738	40	978
9	170	724	30	924
10	100	1453	20	1573
11	170	1443	30	1643
12	170	1472	30	1672
13	170	722	30	922
14	100	1445	20	1565
15	170	1446	30	1646
16	200	1446	30	1676
17	134	723	26	883
18	170	726	30	926
19	200	1467	40	1707
20	170	723	30	923
21	135	1426	25	1586
22	170	722	30	922
23	170	1419	30	1619
24	100	719	20	839
25	100	1456	20	1516
26	68	737	12	817
27	135	1460	25	1620
28	150	729	30	909
29	100	733	20	853
30	135	1465	25	1625

Copied from
Original Record
May 2, 1917.

F. R. WICKS,
Asst. Supt. of Mills.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 232.

2—396

DEPARTMENT OF THE INTERIOR,

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come,
Greeting:

THIS IS TO CERTIFY, That the annexed is a true copy of the only instrument of Writing found of Record from June 19, 1909, up to and including April 7, 1917, which may affect the title of the

Letters Patent of

James M. Hyde,

Number 1,022,085,

Granted April 2, 1912,

for

Improvement in **Art of Concentration** of Mineral Substances.

Recorded in Liber and page as designated on the margin of said Instrument.

Said record has been carefully compared with the original and is a correct transcript of the whole thereof.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 24th day of April, in the year of our Lord one thou-

Defendant's Exhibit No. 232.

sand nine hundred and seventeen, and of the Independence of the United States of America the one hundred and forty-first.

F. W. H. CLAY,
Acting Commissioner of Patents.

Patent Office
United States of America
(Seal)
Liber X 91
Page 300

WHEREAS, I, James M. Hyde, formerly of Basin, Montana, and now of Berkeley, California, did obtain letters patent of the United States for improvement in Art of Concentration of Mineral Substances, which letters patent are numbered 1,022,085, and bear date the 2nd day of April, 1912; and whereas, I am now the sole owner of the said patent and of all rights under the same in the below-recited territory; and whereas Butte and Superior Copper Company, Limited, an Arizona corporation, is desirous of acquiring an interest in the same;

NOW THEREFORE, to all whom it may concern, be it known that, for and in consideration of the sum of One (\$1.00) Dollar, and other valuable consideration, to me in hand paid, the receipt of which is hereby acknowledged, I, the said James M. Hyde, have sold, assigned, and transferred, and by these presents, do sell, assign and transfer unto the said Butte and Superior Copper Company, Limited, all the right, title and

interest in and, to the said invention, as secured to me by said letters patent, for, to and in the County of Silver Bow, State of Montana, and for, to, or in said place or places; the same to be held and enjoyed by the said Butte and Superior Copper Company, Limited, within and throughout the above specified territory, but not elsewhere, for its own use and behoof, and for the use and behoof of its legal representatives or its assigns, to the full end of the term for which said letters patent are or may be granted, as fully and entirely as the same would have been held and enjoyed by me had this assignment and sale not been made. It being the intent hereof that the rights acquired by the Butte and Superior Copper Company, Limited, hereunder may at any time be assigned by the said Butte and Superior Copper Company, Limited, to others.

It is the intent of the said James M. Hyde to assign and transfer to the Butte and Superior Copper Company, Limited, an Arizona corporation, conducting a mining and milling business in Butte, Montana, the exclusive right of treating by my process all ores mined in Silver Bow County, Montana, or shipped into Silver Bow County, Montana, or whether milled in said Silver Bow County, Montana, or outside thereof.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my seal at Butte, in the County of Silver Bow, and State of Montana, this 19 day of April, 1913.

James M. Hyde.

Defendant's Exhibit No. 232.

STATE OF MONTANA,
COUNTY OF SILVERBOW }^{ss:}

On this 19 day of April, 1913, before me, the undersigned, a Notary Public, in and for the State of Montana, residing at Butte, Montana, personally appeared James M. Hyde, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Notarial seal the day and year in this certificate first above written.

LOUIS P. SANDERS
NOTARIAL SEAL
STATE OF MONTANA
Recorded May 7, 1913.

Louis P. Sanders
Notary Public, in and for
the State of Montana,
residing at Butte, Mon-
tana. My commission
expires July 17, 1915.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 233.

Admitted.

Basin, Montana,
September 5, 1911.

Mr. W. A. Clark, Jr.,
Los Angeles, Cal.

Dear Sir:

The fifty ton test plant has now run satisfactorily for such a length of time that I am warranted in assuring you that my adaptation of the gas bubble flotation process is a pronounced success in treating the ore of the Black Rock Mine.

By permission of Mr. Atwater, I enclose herewith a copy of a recent report presented to him; and also refer you to him for a verification of my statements and for any further information you may desire concerning the results of the work we have been doing at Basin.

Since the completion of the machine by the addition of the cleaner, which was part of the original plan, all of the concentrates produced have been of good marketable grade. On two or three occasions the feed has been too coarse for the process, and the concentrate has been of lower grade because of attached particles of silica. Mr. Pratt's samples were taken on one of these occasions. Our shipments of flotation concentrates have steadily increased in grade. Four carloads have averaged as follows:—48.6, 49.6, 51.0, 51.7.

Plaintiffs' Exhibit No. 233

The mill has run a slime department similar to yours with practically the same results which you have obtained. All of the material formerly treated in the slime department is now being treated by the flotation process. We have also treated the accumulated slimes concentrate, raising the grade of the same from about 41% to over 53%.

Mr. Siderfin and Mr. Pratt have visited the plant independently and we gave them samples taken in their presence. On both occasions the machine was just being started up. The first tailings sample was taken in each case before the machine was doing its best work.

I enclose herewith a copy of a letter sent to Mr. Siderfin at his request, and make the following quotation from a letter received from him— "The returns for the samples which I brought back with me are shown on the following page:—

	% Zinc
Heads	20.4
Tails	4.0
Tails No. 2	2.3
Concentrates	52.9

"Mr. Pratt seems to have been quite pleased with the results you were getting on the machine, and has had the samples that he brought back tested with the following results:

Plaintiffs' Exhibit No. 233

	% Zinc.	Ozs. Silver.
Feed	17.0	8.8
Tails	3.6	2.4
Tails No. 2	1.6	1.6
Concentrates	44.7	19.5"

The Butte and Superior Co. is so pleased with the results accomplished that they are now remodelling their plant to provide for fine grinding of the jig tailings and treating them and all of the slimes by the flotation process. The new machine should be running in less than a month from now. They are also getting out plans for a 500 ton mill to be erected at once. I am assisting in getting out these plans.

The patent phase of the situation has been gone into very thoroughly by their local attorneys who have submitted the matter to one of the best firms of patent attorneys in the country, whose report has not yet been received. As the company is going ahead with the use of the process here and are designing the new mill to use it, it is apparent that their investigation has led them to be certain that the threats of litigation have been mere bluffs made in an attempt to make them pay an exorbitant price.

I saw Mr. Pyle in Butte a few days ago and told him that I thought I should wait until the larger machine was working before communicating with you.

I am anxious to get my family away from here before the cold weather sets in. It now appears that things are likely to shape themselves so that we can leave for California in six or seven weeks. There-

Plaintiffs' Exhibit No. 233

fore I have considered it best to inform you of the complete success of the operations here, and to inform you that it is possible to complete an installation for you within four or five weeks if you care to proceed with the matter at once.

My agreement with the Butte and Superior Co. provides for me to be paid in proportion to the extra profit which they make as a result of the use of the flotation process. They expect my compensation to amount of \$30,000, on the basis of \$1,000 for each \$600 extra profit made in a 30 day run.

As your tonnage treated is about one half of theirs and they have borne all of the expense of proving the process a phenomenal success in treating this ore, I prefer to deal with you on the following basis.

If you appoint me as consulting engineer for this work, I will plan and supervise the construction and starting of a flotation machine capable of treating the amount of ore you are now milling. I will leave a man with you who is competent to handle the machine satisfactorily. If you wish me to do so I will act as consultant for you in relation to the work carried on in your Butte mill for one year, without further compensation than the fee herein stated.

I will expect my fee to be \$15,000, to be paid as follows—\$5,000 when the agreement is drawn up and \$10,000 when the machine is completed.

These terms would apply only if the work is to be undertaken at once.

The machinery and construction work necessary

Plaintiffs' Exhibit No. 233

should not cost more than \$4,000 or \$5,000 unless you instal tube mills at an additional cost of \$5,000 to \$6,000. It is very possible that your Chuli mills will grind fine enough so that tube mills will not be needed.

Mr. Atwater will assure you that my estimates of costs and recoveries have been conservative.

Hoping to have an early reply, I remain
Respectfully yours

(Signed) James M. Hyde.

P. S. I will consider it a favor if you do not mention the terms of my contract with the Butte & Superior Co. to anyone.

J. M. H.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Defendant's Exhibit No. 234.

2-390

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR,

United States Patent Office.

To all to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the Records of this Office show that no disclaimer was filed in the United States Patent Office of any claims in Letters Patent of the United States Number 835,120 granted November 6, 1906, to Henry Livingston Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot until March 28, 1917, and that no other disclaimer has been filed than the disclaimer filed on said date of which the attached is a true copy.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 17th day of April, in the year of our Lord one thousand nine hundred and seventeen and of the Independence of the United States of America the one hundred and forty-first.

T. W. H. CLAY

Acting Commissioner of Patents.

Defendant's Exhibit No. 234

\$10.00 REC'D

MAR 28 1917 H

C. C. U S PAT. OFFICE

Disclaimer Recorded March 28, 1917.

UNITED STATES PATENT OFFICE.

Hon. Commissioner of Patents,

Sir:

Your Petitioner, Minerals Separation, Limited, a Corporation organized and existing under the laws of Great Britain and having its principal place of business in London, England, hereby represents as follows:

1. That on November 6th, 1906, Letters Patent of the United States for Ore Concentration, No. 835,120, were granted to Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, of London, England, and your Petitioner is now the sole and exclusive owner of the said Letters Patent.

2. That by the decision of the Supreme Court of the United States in Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, vs. James M. Hyde, filed the 11th day of December, 1916, your Petitioner is advised that the said Letters Patent No. 835,120, in so far as concerns Claims 9, 10 and 11 thereof, covers and includes more than the said inventors had a right to claim as new.

3. That the matter which the said patentees and

Defendant's Exhibit No. 234

your Petitioner are, in accordance with the said decision of the said Court, not entitled to hold or claim by virtue of said claims 9, 10 and 11 of said Letters Patent No. 835,120, was included therein by mistake, and without fraudulent or deceptive intent, and without any willful default or intent to defraud or mislead the public.

4. That the subject-matter not herein and hereby disclaimed is definitely distinguishable from the part or parts disclaimed herein, and is truly and justly the invention of the said Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, and is a material and substantial part of the thing patented.

Your petitioner, therefore, for the purpose of complying with the requirements of the law in such case made and provided, and of disclaiming those parts of the thing patented which your Petitioner does not choose to claim or hold by virtue of said Letters Patent No. 835,120, does hereby disclaim from claims 9, 10 and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent on the ore.

IN WITNESS WHEREOF your Petitioner has caused these presents to be signed and sealed by John Ballot, its duly constituted attorney in fact under and by virtue of a power of attorney dated December 14, 1915, and recorded in the United States Patent Office November 27, 1916, in Liber K 101, page 176 of

Defendant's Exhibit No. 234

Transfers of Patents, this 27th day of March, 1917.

Minerals Separation Limited

by John Ballot

Attorney in fact

In presence of:

S. Gregory,

Henry D. Williams

STATE OF NEW YORK,

County of New York,—ss:

On this 27th day of March, 1917, before me personally came John Ballot, attorney in fact of Minerals Separation Limited, a Company organized under the laws of Great Britain, to me personally known, and known to me to be the individual described and who, as such attorney, executed the within petition and acknowledged that he executed the same as the act and deed of Minerals Separation, Limited, therein described, by virtue of a power of attorney duly executed by said Minerals Separation, Limited, bearing date December 14, 1915, which power of attorney was exhibited to me, and he stated that it was still in force and effect.

Harry C. Lewis,

Notary Public Bronx Co. No. 12.

Certificate filed in New York

Seal.

County No. 41.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Defendant's Exhibit No. 235.

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 118.

APRIL 28TH

General Flotation Operation:—

The oils used were:—

Standard Yaryan Pine	18.53%	of total oil
Fuel Oil	70.62%	of total oil
Commercial Kerosene	10.85%	of total oil

Period of Operation	24 hours
Flotation feed tonnage, 24 hrs.	1262 dry tons
Flotation concentrates produced	300 dry tons
Temperature of feed	Atmospheric
Dilution of feed	4.93 : : 1

OILS AND REAGENTS USED

Pine Oil lb./Ton	Fuel Oil lb./Ton	Commercial Kerosene lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
3.69	14.05	2.16	11.11	(a) 5.92

(a) Equivalent to 0.09 pounds metallic copper per ton.

Metallic copper consumed 113.62 pounds

Actual initial oil added:—

Commercial Kerosene	2,725	pounds
Fuel Oil	17,737	"
Standard Yaryan Pine	4,655	"
Actual initial oil added	25,117	"
Initial oil added per ton	19.90	"

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 118

APRIL 28TH

The assay results and oil analyses for this date are as follows:—

	Flotation Feed Including Circulating Load		Tailing		Concentrate	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
7-3 Shift	15.8	1.55	1.81	0.63	41.9	2.21
3-11 "	15.0	1.59	1.39	.45	42.5	2.89
11-7 "	12.5	1.88	1.45	.71	43.8	3.31
Average	(^b)14.43	(^b)1.67	(^a)1.56	(^b) .60	(^a)42.8	(^b)2.80

(a)—Assay composites

(b)—Numerical averages

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

General Flotation Operation:—

1st Period—7:00 A. M. to 1:00 P. M. and
5:00 P. M. to 7:00 A. M.

The oils used were:—

Commercial Kerosene	11.23%	of total oil
Fuel Oil	64.47%	of total oil
Standard Yaryan Pine	24.30%	of total oil
Period of Operation	20	Hours
Tonnage treated per 20 hours	1239.47	dry tons
Flotation concentrate produced	282.84	dry tons
Temperature of feed	Atmospheric	
Dilution of feed	3.97	: : 1

Defendant's Exhibit No. 235

OILS AND REAGENTS USED

Commercial Kerosene lb./Ton	Fuel Oil lb./Ton	Pine Oil lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
2.67	15.32	5.77	6.87	(a) 6.27

(a) Equivalent to 0.10 pounds metallic copper per ton
 Metallic copper consumed 118.09 pounds
 Initial oil added per ton 23.76 pounds.

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

General Flotation Operation:—

2nd Period—1:00 P. M. to 5:00 P. M.

The oils used were:—

Commercial Kerosene	11.23%	of total oil
Fuel Oil	64.47%	of total oil
Standard Yaryan Pine	24.30%	of total oil
Period of operation	4	hours
Tonnage treated per four hours	263.53	dry tons
Flotation concentrate produced	60.16	dry tons
Temperature of feed	Atmospheric	
Dilution of feed	3:45 : : 1	

OILS AND REAGENTS USED

Commercial Kerosene lb./Ton	Fuel Oil lb./Ton	Pine Oil lb./Ton	Sulphuric Acid lb./Ton	A.C.M. Solution Copper Sulphate lb./Ton
2.96	17.00	6.41	7.08	(a) 6.50

(a) Equivalent to 0.10 pounds metallic copper per ton
 Metallic copper consumed 26.02 pounds
 Initial oil added per ton 26.37 pounds

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

Actual initial oil added during 24 hours period:—

1st Period—7:00 A. M. to 1:00 P. M. and
5:00 P. M. to 7:00 A. M.

Commercial Kerosene	3,306 pounds
Fuel Oil	18,988 pounds
Standard Yaryan Pine	7,155 pounds
	<hr/>
Total	29,449 pounds

2nd Period—1:00 P. M. to 5:00 P. M.

Commercial Kerosene	780 pounds
Fuel Oil	4,479 pounds
Standard Yaryan Pine	1,689 pounds
	<hr/>
Total	6,948 pounds

Total actual initial oil added	36,397 pounds
Total actual initial oil added per Ton	24.21 pounds

HJS:JDS

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 119

APRIL 29TH

The assay results and oil analysis for this date are as follows:—

1st Period—7:00 A. M. to 1:00 P. M. and

5:00 P. M. to 7:00 A. M.

	Flotation Feed Including Circulating Load.		Tailing.		Concentrate.	
	Assay % Zn.	Analysis % Oil.	Assay % Zn.	Analysis % Oil.	Assay % Zn.	Analysis % Oil.
7:00 A. M. - 1:00 P. M.	12.1	2.34	1.19	1.29	44.3	3.18
5:00 P. M. - 11:00 P. M.	13.7	2.62	1.69	1.18	46.8	4.72
11:00 P. M. - 7:00 A. M.	13.9	1.88	1.57	1.47	45.2	3.31
Average.....	(a) 13.2	(a) 2.28	(b) 1.55	(a) 1.31	(b) 45.6	(a) 3.74

2nd Period—1:00 P. M. to 5:00 P. M.

	Flotation Feed Including Circulating Load		Tailing		Concentrate	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
1:00 P. M. to 5:00 P. M.	12.6	1.77	1.57	0.67	45.2	3.13

HJS:JDS

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 120

APRIL 30TH

General Flotation Operation:—

The Oils used were:—

Standard Yaryan Pine	9.68%	of total oil
Fuel Oil	78.58%	of total oil
Commercial Kerosene	11.74%	of total oil
Period of operation	24	hours
Flotation feed tonnage 24 hours	1608	dry tons
Flotation concentrates produced	383	dry tons
Temperature of feed	Atmospheric	
Dilution of feed	3.53	: : 1

OILS AND REAGENTS USED

Pine Oil lb./Ton	Fuel Oil lb./Ton	Commercial Kerosene lb./Ton	Sulphuric Acid lb./Ton	Copper Sulphate A.C.M. Solution lb./Ton
2.61	21.16	3.16	6.46	(a) 6.80
(a) Equivalent to 0.10 pounds metallic copper per ton				
Metallic copper consumed				166.12 pounds
Actual Initial Oil added:—				
Commercial Kerosene				5,085 pounds
Fuel Oil				34,027 pounds
Standard Yaryan Pine				4,189 pounds
Total				<u>43,301</u> pounds
Initial oil added per ton				26.93 pounds

Defendant's Exhibit No. 235

BUTTE & SUPERIOR MINING COMPANY

REPORT NO. 120

APRIL 30th

The assay results and oil analyses for this date are as follows:

	Flotation Feed Including Circulating Load		Tailing		Concentrate	
	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil	Assay % Zn.	Analysis % Oil
7-3 Shift	13.3	1.87	1.72	0.69	42.8	3.42
3-11 "	12.5	2.08	1.44	0.73	42.7	4.05
11-7 "	18.6	1.74	2.52	1.36	43.6	4.26

Average (b)14.8(b)1.90(a)1.92(b) .93(a)43.4(b)3.91

(a)—Assay composites

(b)—Numerical averages

HJS:JDS

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 236.

UNITED STATES DISTRICT COURT,
DISTRICT OF MONTANA.

MINERALS SEPARATION, LIM-
ITED,

Plaintiff,

vs.

BUTTE & SUPERIOR MINING
COMPANY,

Defendant.

STATE OF NEW YORK, }
County of New York. } ss:

HARRY FALCK, being duly sworn, deposes and says:

I am a resident of the City of New York, State of New York, and am the general office manager for Beer, Sondheimer & Co. Inc., the American agents for Minerals Separation Ltd., the plaintiff in this action.

It is a part of my duty as office manager for said Beer, Sondheimer & Co. Inc. to be familiar with the granting of licenses by Minerals Separation Ltd. in this country and the payment of royalties thereunder. It is my duty to receive the statements of returns rendered by the licensees of the patent here in suit to the plaintiff herein, and to prepare bills based on such statements if correct for royalties due under the licenses and to keep account of the royalties paid to Beer, Sondheimer & Co. Inc. as agents for the plain-

Plaintiffs' Exhibit No. 236

tiff. I have prepared a statement giving the name of each licensee, the period during which the process of the patent in suit has been carried on by such licensee, the number of tons of material treated, or the number of tons of concentrates recovered, and the amount of royalties paid to Minerals Separation Ltd. by such licensee which is hereto annexed. These figures are taken from the statement of returns rendered to Minerals Separation Ltd. by the licensees and from the books of Beer, Sondheimer & Co. Inc., and have been carefully checked by me, and are true and correct.

Subscribed and sworn to before
me this 10th day of April, 1917

(Seal)

Harry Falck.

Harry C. Lewis

Notary Public, Bronx Co. No. 11

Certificate filed in New York County No. 93.

Plaintiffs' Exhibit No. 236

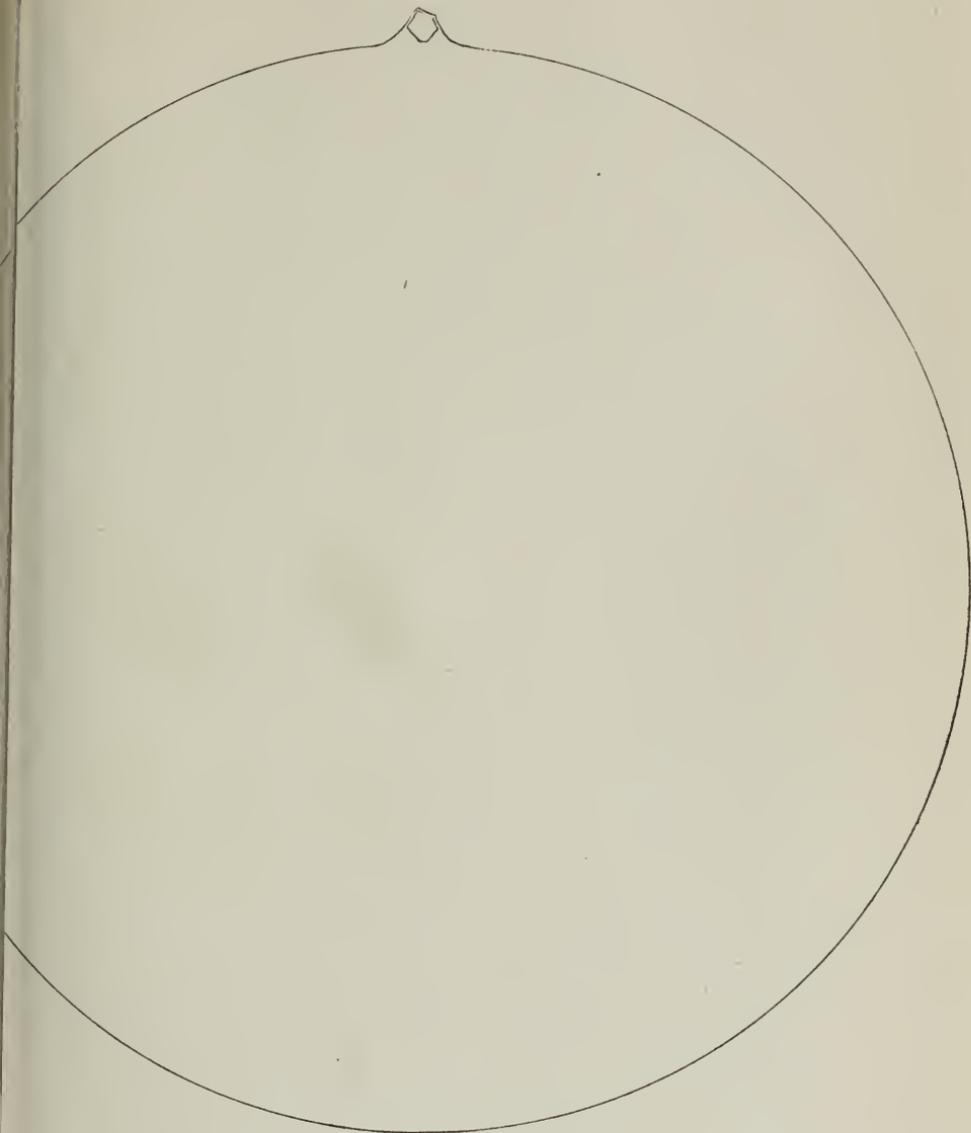
TABLE OF RETURNS AND PAYMENTS OF ROYALTIES BY
UNITED STATES LICENSEES OF MINERALS SEPARATION, LIMITED

NAME	Period	Tonnage Material Treated	Tonnage Concentrates Recovered	Amount
Inspiration Cons. Copper Co.	Jan. /14 to June 30/15	257270.4	Not Reported	\$30871.36
Consolidated Arizona Smelt. Co.	June /14 to Jan. /17	197952.65	Not Reported	26595.24
Atlas Min. & Milling Co.	Oct. /13 to Dec. 31/16	102596.50	Not Reported	14730.27
Anaconda Copper Mining Co.				
Canaanca Cons. Copper Co.	Apr. 1/15 to Dec. 31/16	11785189.3455	Not Reported	536826.60
Inspiration Cons. Copper Co.				
Arizona Copper Company, Ltd.				
Mountain Copper Company, Ltd.	Apr. 1/15 to Dec. 31/16	98573.10	Not Reported	12847.12
Engels Copper Mining Company	Jan. 1/15 to Dec. 31/16	200135.34	Not Reported	26644.21
Utah Leasing Company	Nov. /15 to Dec. 31/16	175923.00	Not Reported	10535.38
Colusa Parrot Min. & Smelt. Co.	July /16 to Jan. /17	69798.9635	Not Reported	4188.00
Chichagoff Mining Company	July 1/16 to Dec. 31/16	13094.00	Not Reported	1309.40
Stoddard Milling Company	Aug. 14/16 to Dec. 31/16	14716.00	Not Reported	3769.00
Goldfield Cons. Mines Co.	Mar. /16 to Nov. /16	37789.00	Not Reported	7557.80
Elm Orlu Mining Company	June 26/14 to Dec. 31/16	Not Reported	121630.713	141627.68
St. Joseph Lead Company	Apr. /14 to Dec. 31/16	Not Reported	42550.747	26271.39
Doe Run Lead Company	Apr. /14 to Dec. 31/16	Not Reported	23516.759	18217.08
Desloge Cons. Lead Company	Jan. 1/16 to Dec. 31/16	Not Reported	5337.945	4689.89
Maxwell W. Atwater	June 22/14 to Sep. 30/16	Not Reported	10643.155	13303.93
McDonald & Noble	Oct. /13 to Dec. 31/16	Not Reported	9418.000	5602.68
Weedon Mining Company	July 23/15 to June 1/16	Not Reported	1225.00	833.00
Butte Central Min. & Mill. Co.	to Mar. 1/17	Not Reported	588.646	990.00
Napoleon Mining Company	Oct. 1/15 to June 30/16	Not Reported	430.929	298.38
Dutch Sweeney Mining Company	Dec. /16 to Feb. /17	Not Reported	2126.45	531.61
Portland Gold Mining Company	Nov. /15 to Sep. 30/16	Not Reported	9602.5779	2400.64

\$1155258.24

Plaintiffs' Exhibit No. 237.

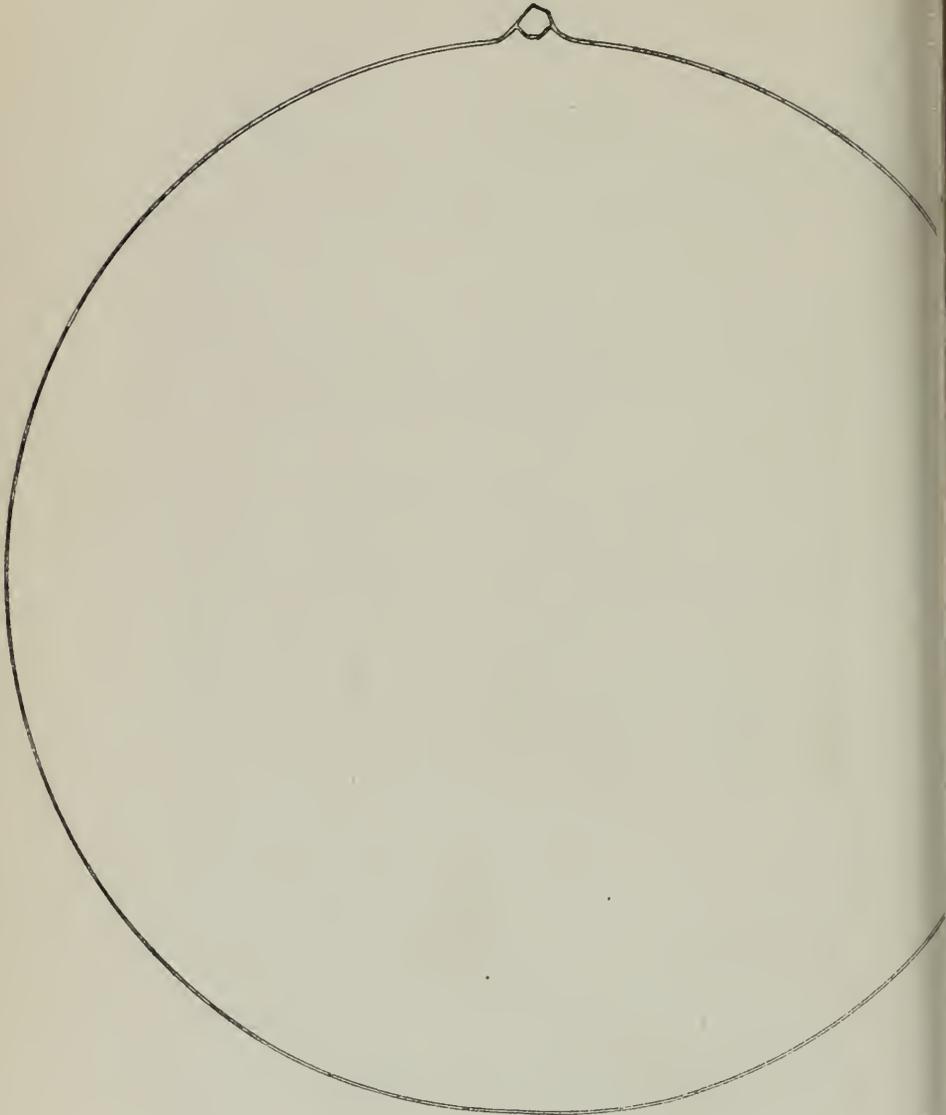
Diagram No. 1



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 238.

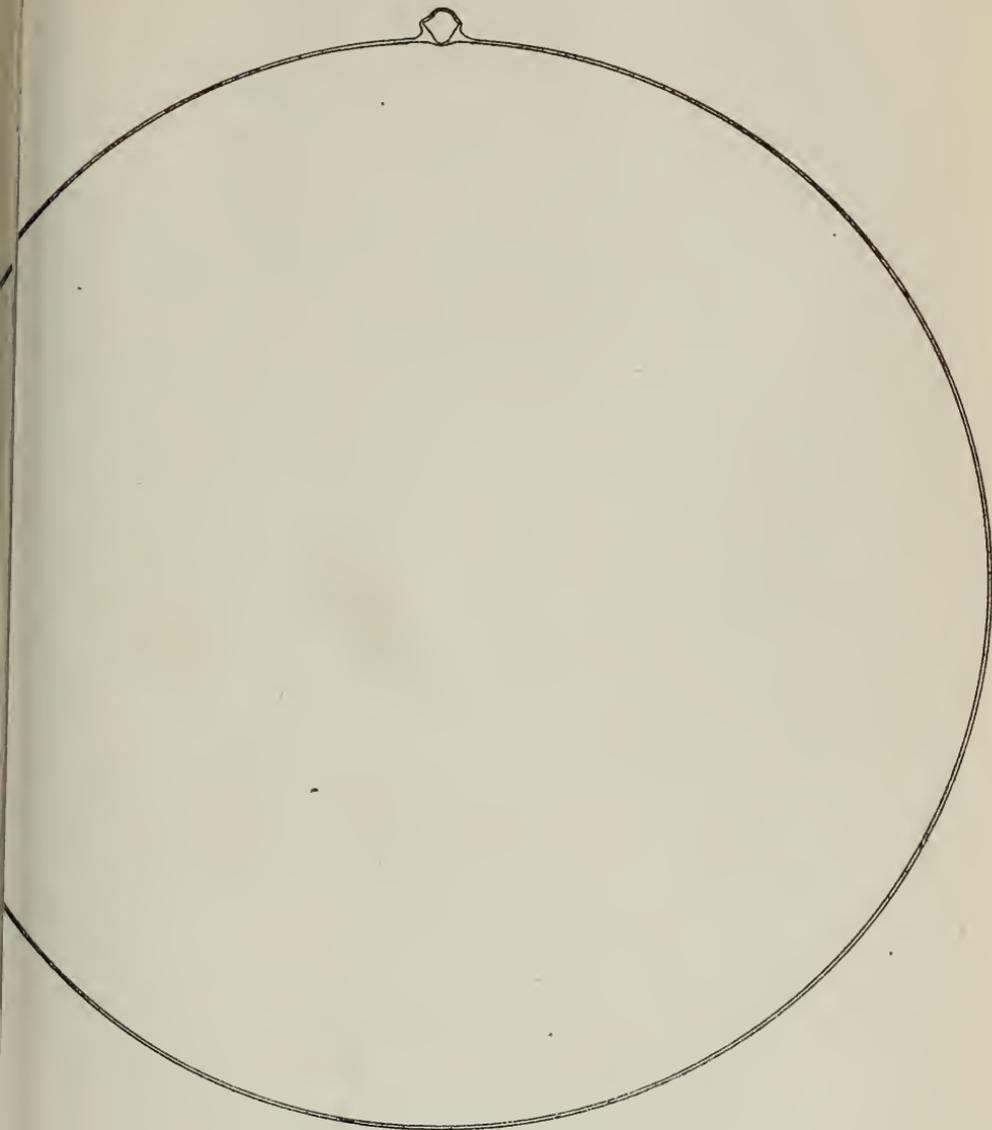
Diagram No. 2



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 239.

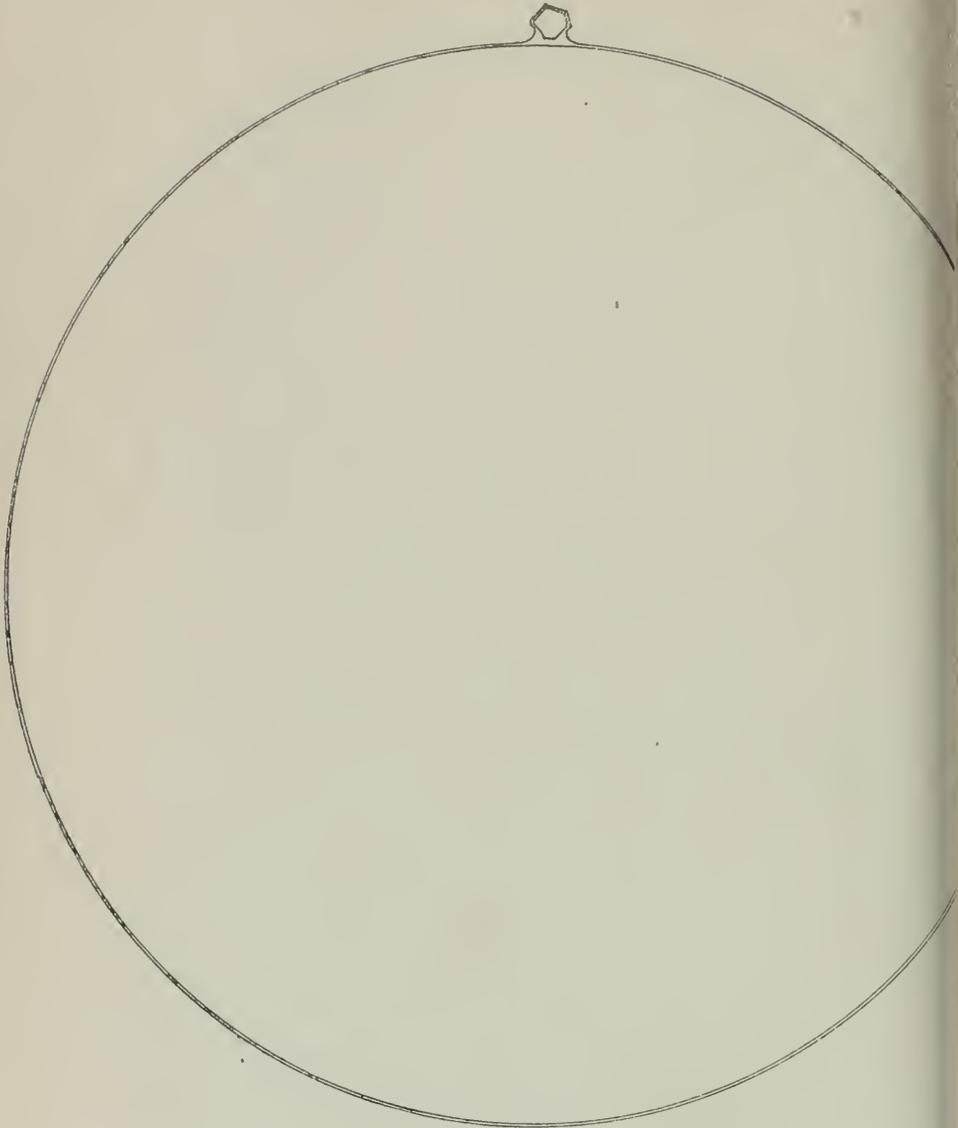
Diagram No. 3



Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

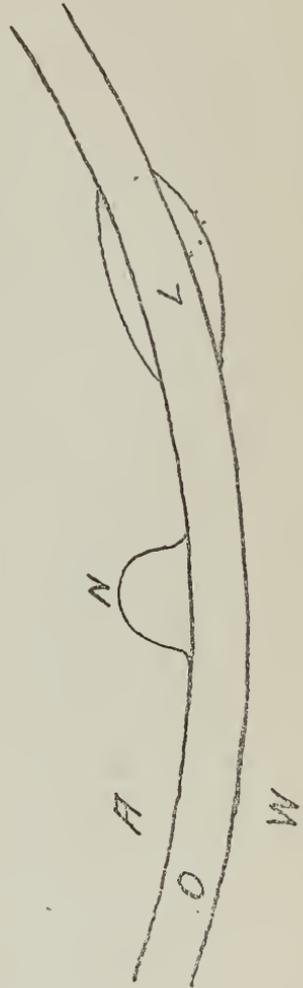
Plaintiffs' Exhibit No. 240.

Diagram No. 4

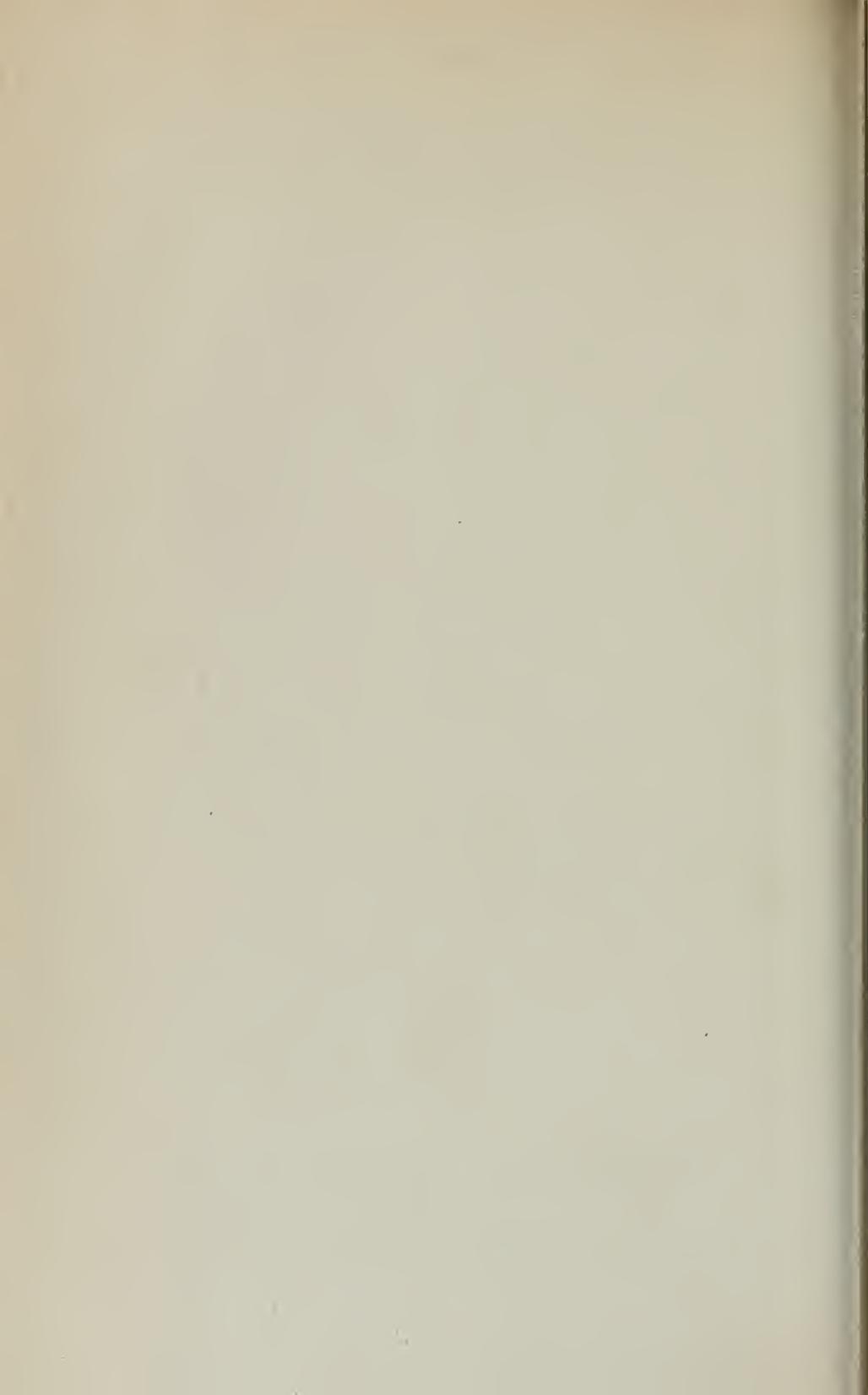


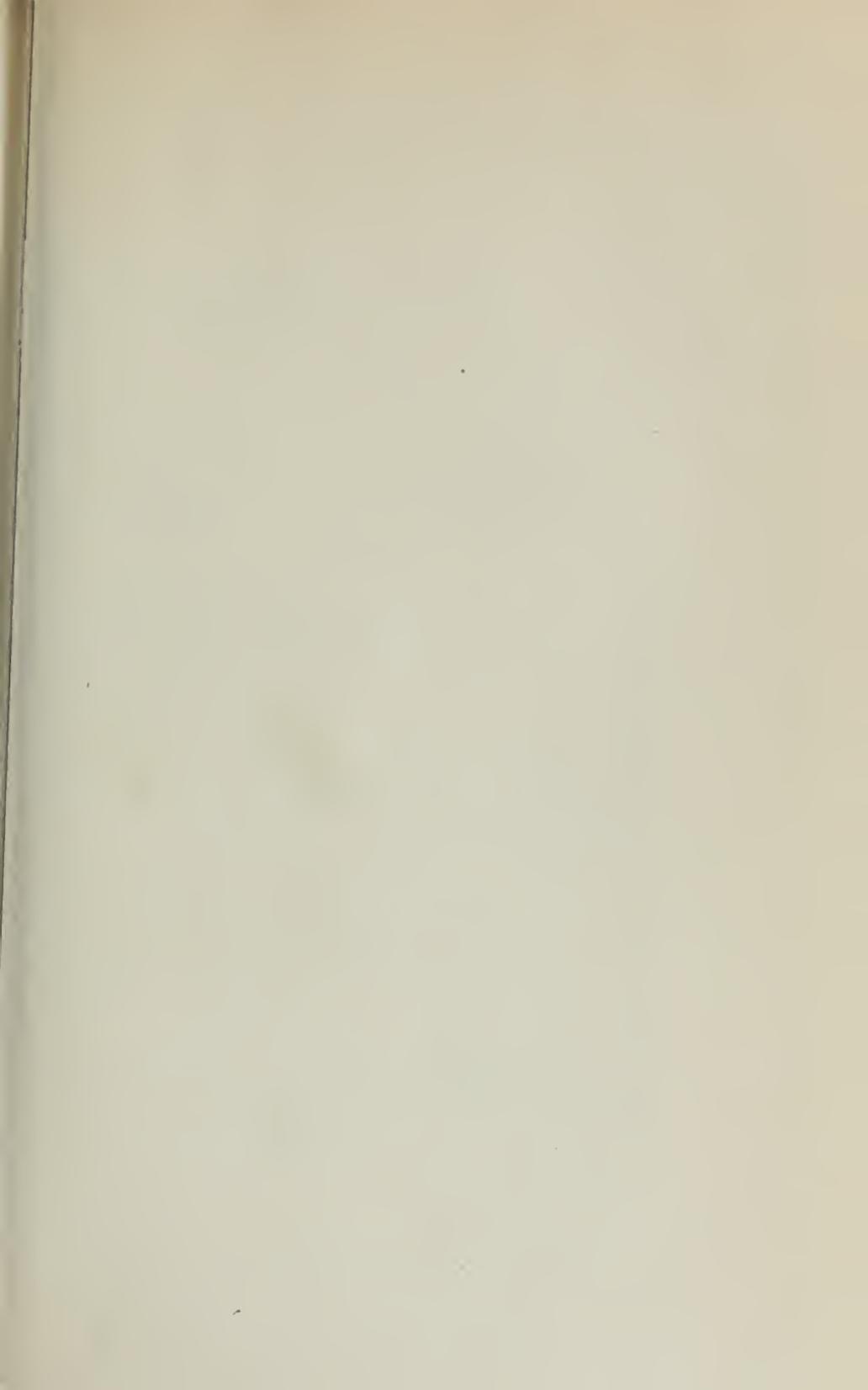
Filed August 15, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

DIAGRAM NO. 3 - PLANTY III J Zamboni - No. 300



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

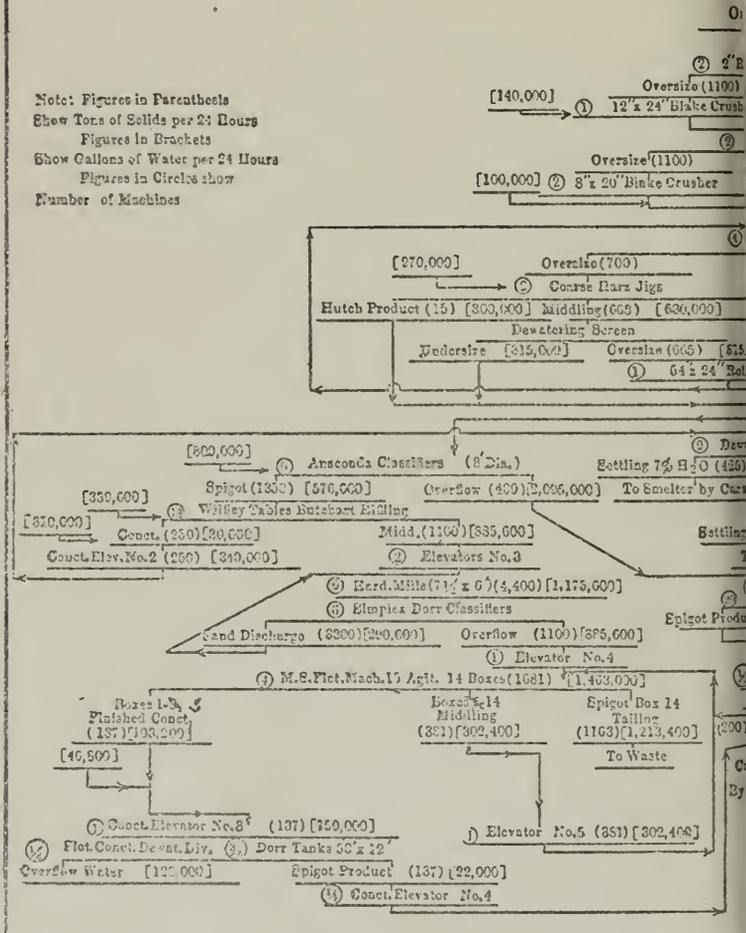




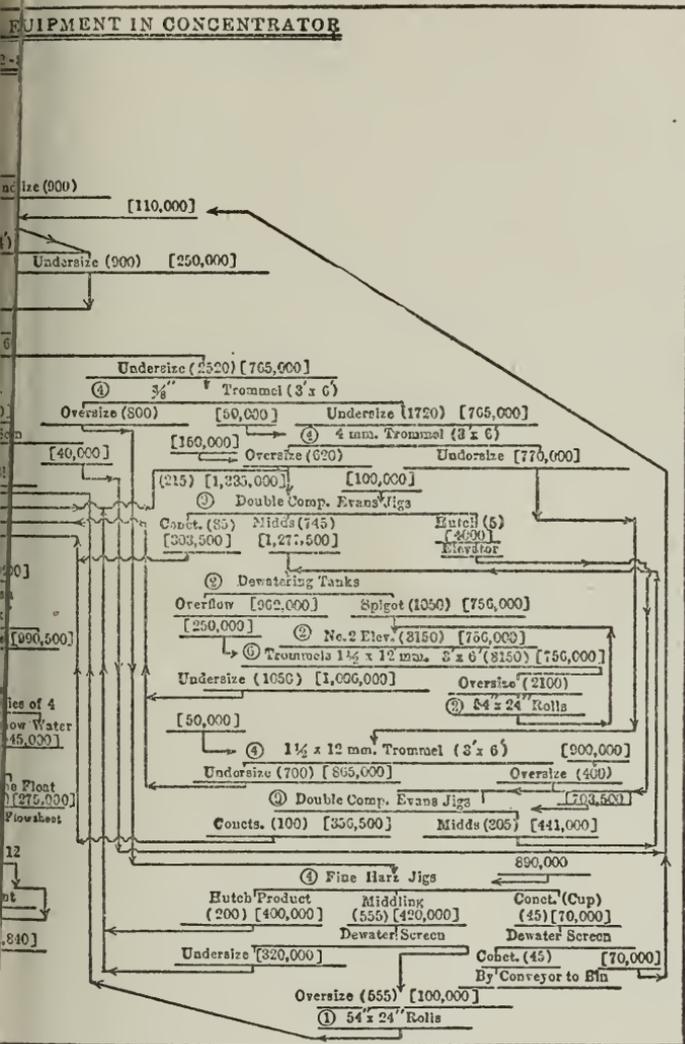
INSTALLATION OF FINER GRINDING

FLOW SHEET

Note: Figures in Parentheses
 Show Tons of Solids per 24 Hours
 Figures in Brackets
 Show Gallons of Water per 24 Hours
 Figures in Circles show
 Number of Machines



N. 242.



FLOTATION CONCENTRATION AT ANACONDA, MONT.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 243.

ANACONDA COPPER MINING CO.

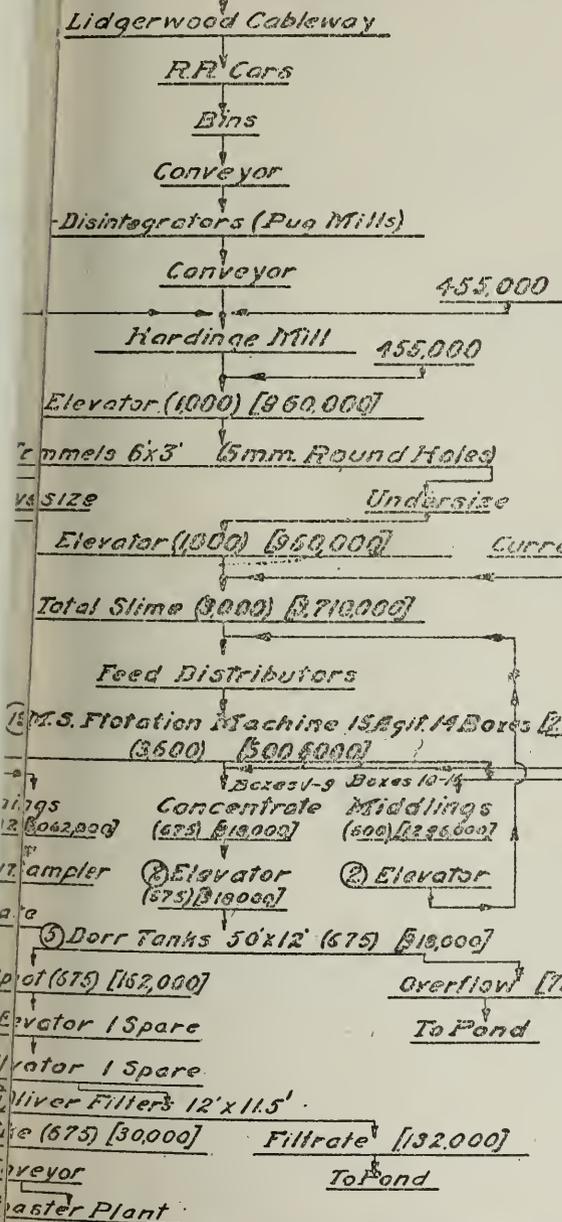
SLIME FLOTATION PLANT AT ANACONDA

Slime 20% moisture (1000) [50,000]

Notes:-

This flow sheet shows the current slime and pond slime mixed together for treatment. They may, however, be treated separately.

The figures in circles denote the number of machines. Those in brackets, the number of gallons of water per 24 hours and those in parenthesis, the number of tons of solids in 24 hours.

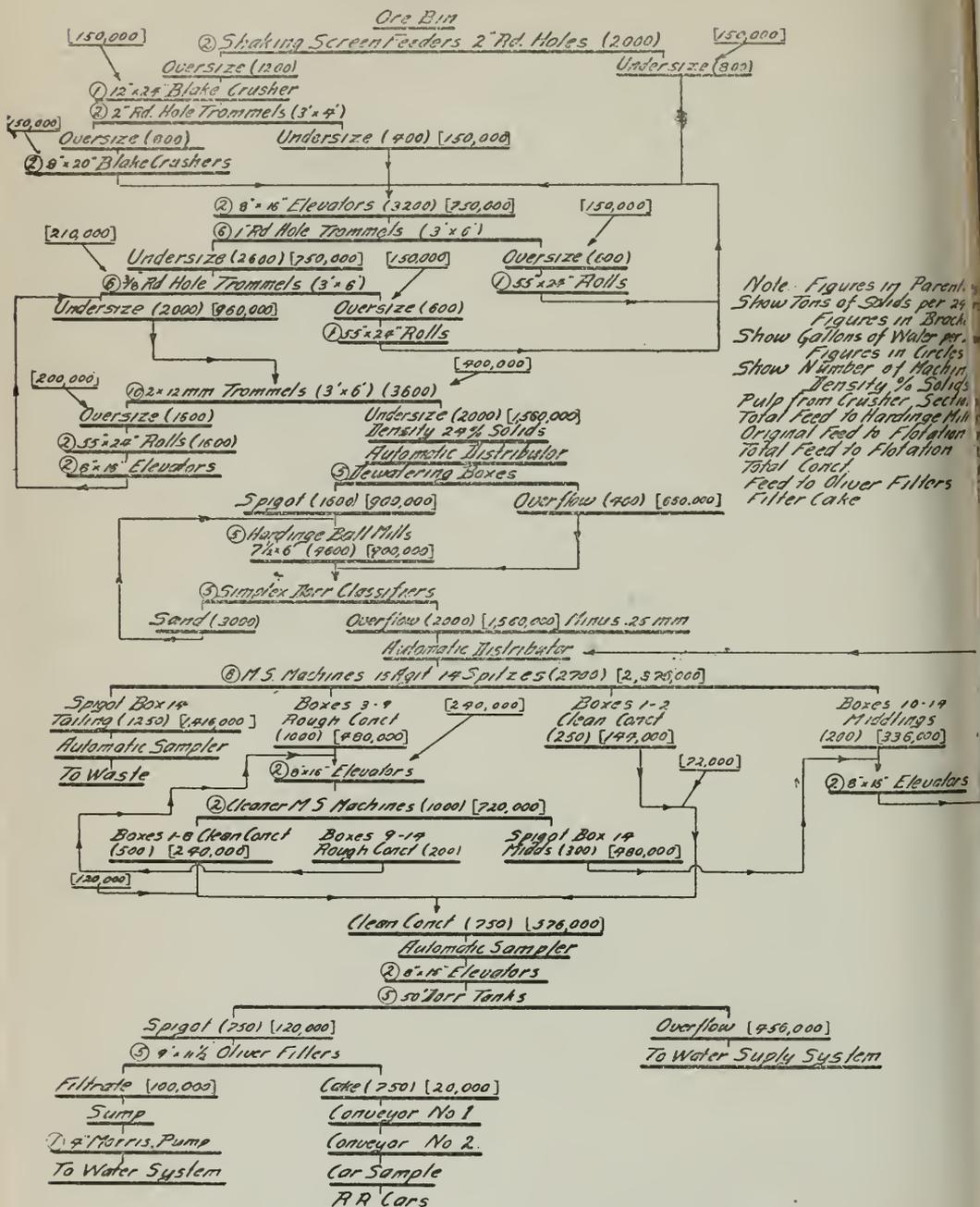


The following quantities of reagents will be used.
 H₂SO₄ 60° B, abt. 12 lbs. per ton of solids. Crude wood creosote, abt. 2.5 lbs. per ton of solids. Ferrosene sludge acid, abt. 2.5 lbs. per ton of solids. The pulp will be heated to abt. 60° to 70° F.

Cooling water from the roaster plant at a temperature abt. 175° F, will be added to the slime pulp bringing the temperature of the latter up to abt. 70° F.

Plaintiffs' Exhibit No. 244.

Zinc Ore Concentrator
Flow sheet 2000 Ton Unit



Note: Figures in Parenthesis Show Tons of Solids per 24 Figures in Brackets Show Gallons of Water per. Figures in Circles Show Number of Machines Density, % Solids Pulp from Crusher, Section Total Feed to Hardinge Mill Original Feed to Flotation Total Feed to Flotation Total Conc. Feed to Oliver Filters Filter Cake

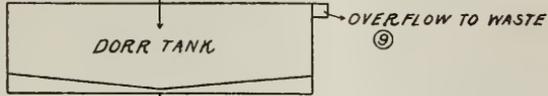
April 1st 1917

PLAINTIFFS EXHIBIT N° 245

FLOW SHEET
MAGNA MILL, UTAH COPPER CO.,
FLOTATION SECTION

PROF FULTON & PARTY
VISIT OF APRIL 22ND

VANNER CONCENTRATES
CLASSIFIER OVERFLOW



(3)

(2)

SLUDGE TANK

AVERAGE DEPTH
MAINTAINED 4 FT

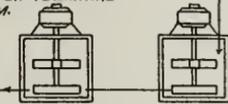
COMPRESSED AIR FOR AGITATION

MAIN CALURA ADDITION (7)

NEW OIL ADDITION (6)
MAINTAINED AT 62° C

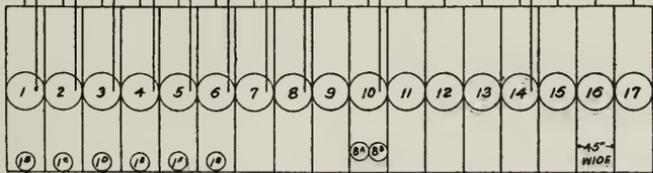
TWO EMULSIFIERS
DRIVEN BY 10HP INDUCTION MOTORS
440 VOLTS 14.6 AMP PER TERMINAL
60 CYCLES, 570 R.P.M.

FRESH CIRCUIT WATER (12)



CALURA FEED

MIDDINGS AS CIRCULATING LOAD



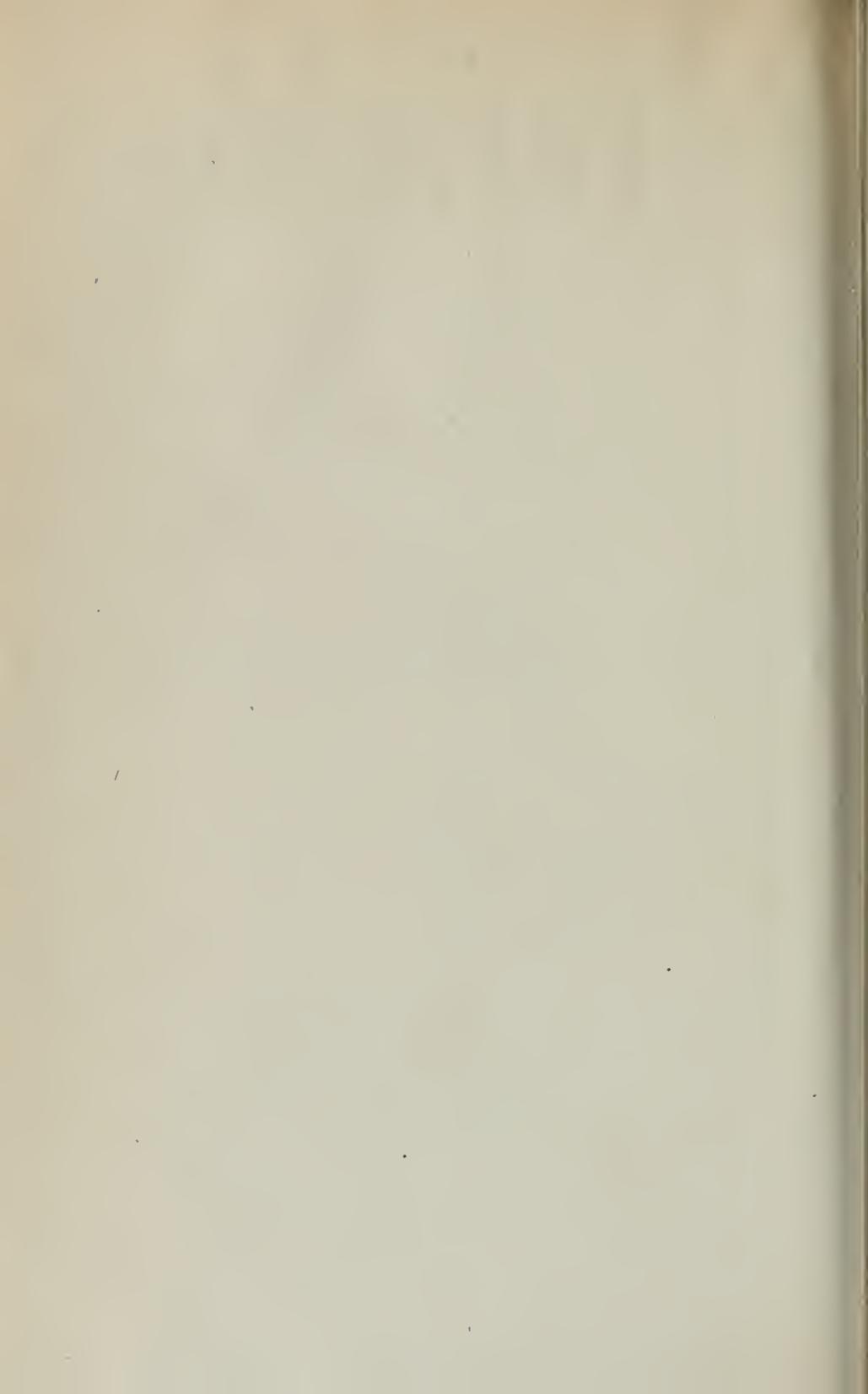
TAILINGS (11)

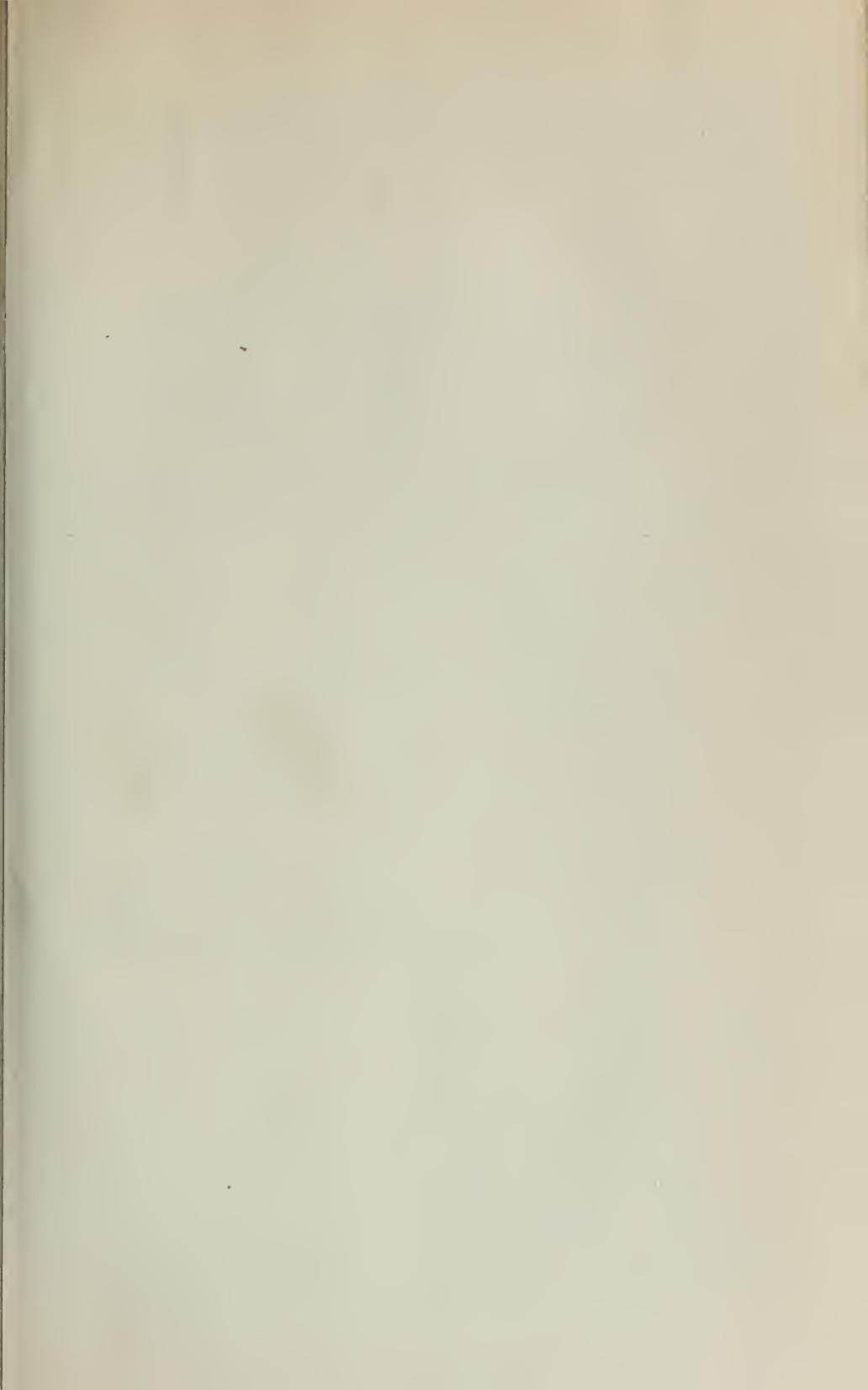
17 CELL JANNEY MACHINE

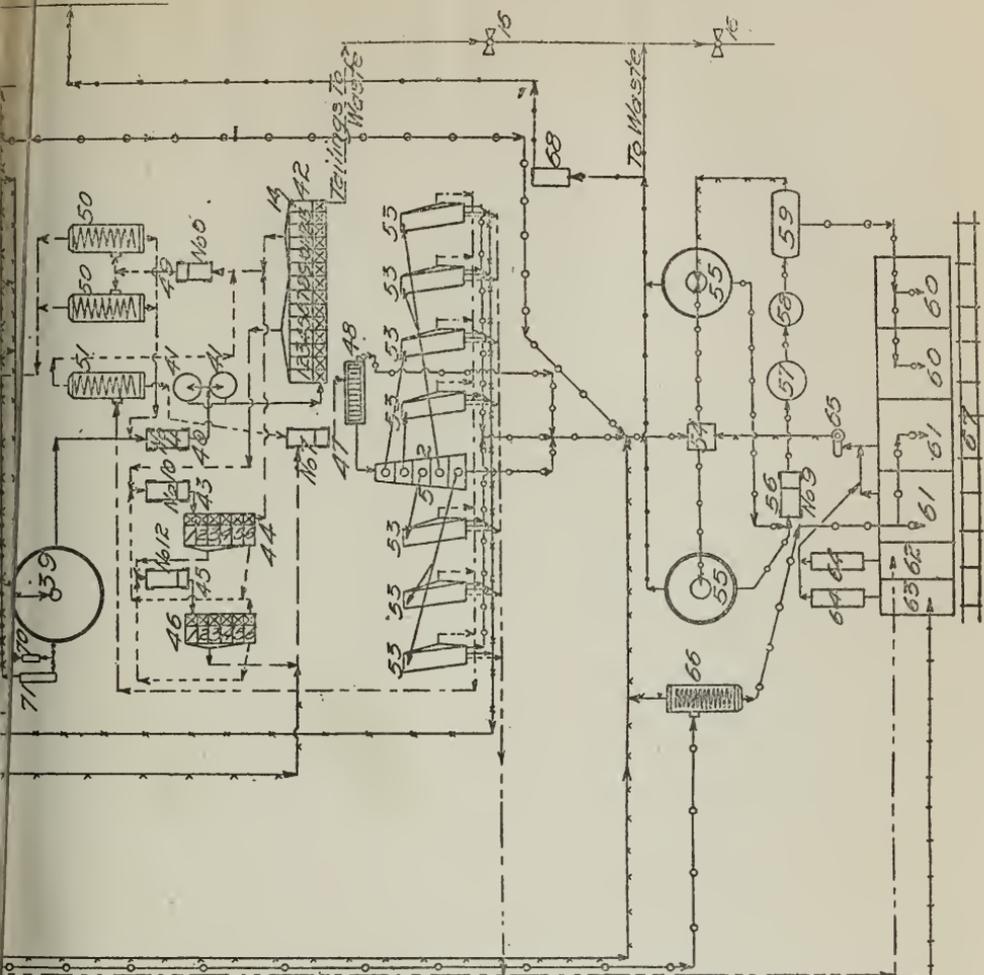
OVERFLOWS INTERMITTENTLY
CONTINUEDLY MANIPULATED
TO OVERFLOW CONTINUOUSLY

TO FINISHED
CONCENTRATES (8)

MIDDINGS



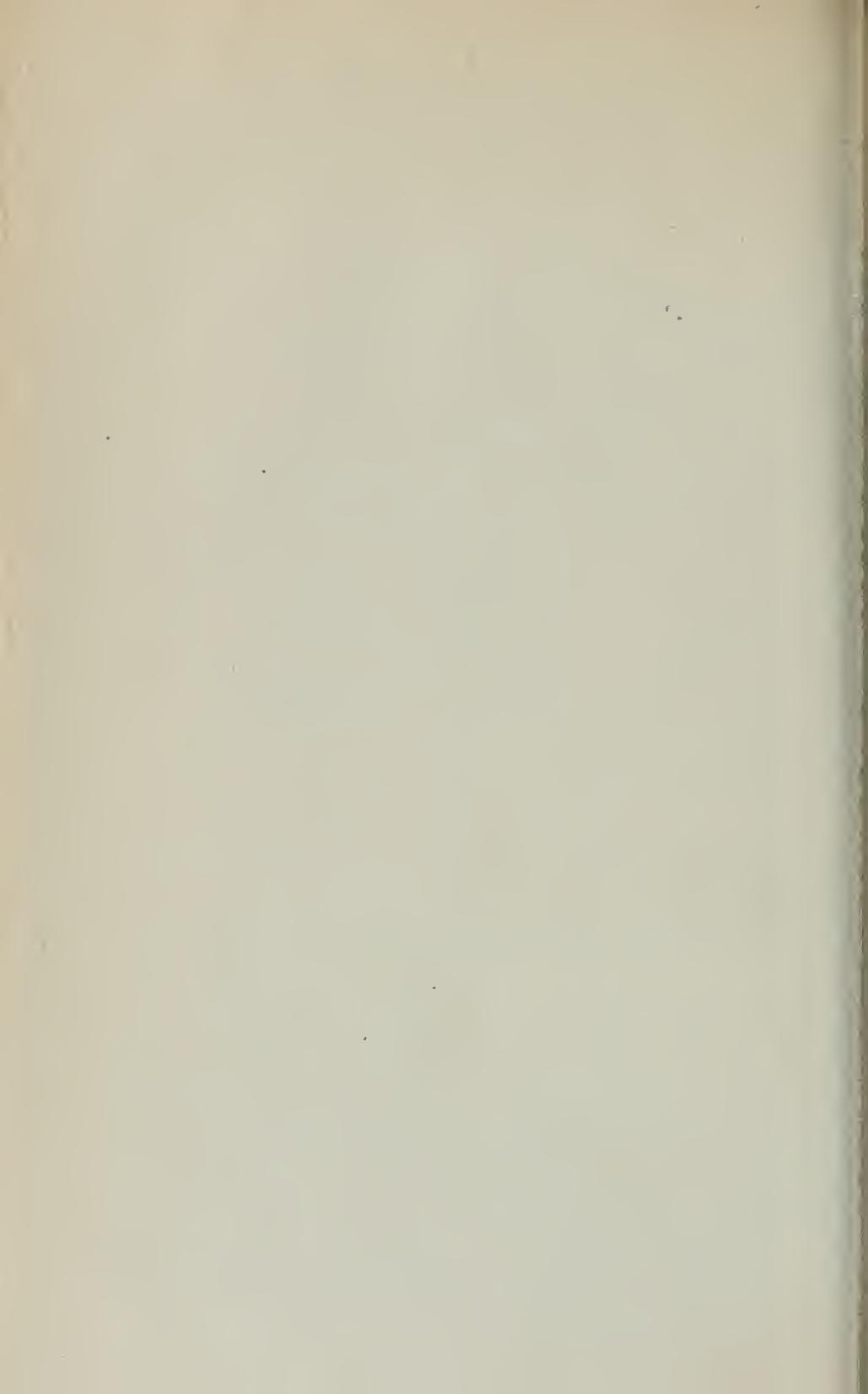




54-1 Distributing Box
 55-2 20" Thickens 29 x 6' Reches & R.P.M.
 56-1 Belt Elevator No. 9, 57' H. Ctr., 452' F.P.M.
 57-1 Agitator Tank 14' x 10' FT
 58-1 Mottle Ju Tank
 59-1 Holly Filter Press, 850 Type
 60-2 Fine Zinc Concentrate Bins
 61-2 Coarse " "
 62-1 Lead
 63-1 Copper
 64-2 Settling Tanks
 65-1 Centrifugal Pump
 66-1 Akins Classifier 45' 7 1/2' P.M.
 67-1 Concentrate Loading Track
 68-1 Platt Triplex Pump
 69-1 Dirty Water Tank
 70-1 Centrifugal Pump
 71-1 Camer-on Steam Pump
 72-1 Fresh Water Tank

→ LEGEND →
 ——— Feed
 - - - - - Zinc, Silical Middling
 - - - - - Lead
 - - - - - Lead Iron-Copper-Zinc Mchling
 - - - - - Flotation Middling
 - - - - - Coarse Zinc Concentrate
 - - - - - Fine " "
 - - - - - Unfinished " "
 - - - - - Lead
 - - - - - Copper
 - - - - - Unfinished Tailings
 - - - - - Final Mill
 - - - - - Classifier Overflow
 - - - - - Clear Return Water-Offlow
 - - - - - Dirty " "

Timber Butte Milling Co.
 Butte, Montana
 Mill Flow Sheet No. 6
 Drawn by Test Approved & Checked
 Checked by Date 5-9-17
 F 116



TIMBER BUTTE MILLING CO
BUTTE MONT.

FLOTATION OIL CONSUMPTIONS AND ACID CONSUMPTIONS

	FLOTATION OIL		FLOTATION ACID.		OILS USED TIMBER BUTTE MILLING CO'S NUMBERS
	POUNDS PER TON OF ORIGINAL FEED	POUNDS PER TON OF FLOTATION FEED	POUNDS PER TON OF ORIGINAL FEED	POUNDS PER TON OF FLOTATION FEED	
NOV-1914	.54	.60	9.77	10.84	No- 6, 140.
DECEMBER 14	.49	.54	9.18	10.15	No- 6, 10, 140.
DEC-1914	.51	.56	9.03	9.99	No- 6, 10, 140
DEC 1914	.60	.78	9.41	10.73	No- 6, 10.
DEC 1914	.76	.82	8.61	9.39	No- 6, 10.
7 MONTHS DEC 1914	.61	.66	9.38	10.17	
NOV-1915	.81	.87	7.70	8.36	No- 6, 10.
NOV-1915	.69	.73	5.56	5.89	No- 6, 10, 12, 50, 90.
NOV-1915	.71	.75	5.11	5.43	No- 6, 10, 12, 52, 88, 90, 160.
NOV-1915	.85	.94	6.45	7.13	No- 6, 10.
NOV-1915	.85	.93	8.17	8.87	No- 6, 10, 87.
NOV-1915	.65	.70	8.69	9.38	No- 10, 87
NOV-1915	.84	.90	17.06	18.22	No- 6, 10, 87, 89, 171, 174.
NOV-1915	.83	.90	12.91	13.86	No- 10, 87, 174, 192.
NOVEMBER 1915	1.40	1.49	15.94	17.03	No- 10, 156, 174, 191, 192.
NOVEMBER 1915	1.66	1.82	8.82	9.66	No- 170, 174, 191, 192
NOVEMBER 1915	1.10	1.19	8.16	8.77	No- 6, 21, 23, 87, 110, 174, 192.
NOVEMBER 1915	1.34	1.46	9.67	10.53	No- 6, 21, 23, 87, 110, 192.
NOV-1915	.97	1.05	9.22	9.94	
NOV-1916	1.27	1.36	13.74	14.70	No- 23, 87, 24, 174.
NOV-1916	.54	.58	12.20	13.07	No- 23, 170A.
NOV-1916	.46	.49	9.77	10.37	No- 170A, 192.
NOV-1916	.56	.59	10.93	11.57	No- 170A, 192
NOV-1916	.56	.59	10.51	11.11	No- 170A, 191, 192.
NOV-1916	.51	.55	7.72	8.18	No- 87A, 170A, 191, 192.
NOV-1916	.66	.70	8.83	9.21	No- 170A, 191, 192, 270.
NOV-1916	.62	.67	7.54	8.12	No- 87A, 170A, 192
NOVEMBER 1916	.73	.78	7.83	8.37	No- 87A, 23.
NOVEMBER-1916	.68	.73	7.31	7.81	No- 87A, 171.
NOVEMBER 1916	.72	.79	8.43	9.23	No- 87A, 171
NOVEMBER 1916	.59	.64	9.03	9.78	No- 87A, 171
NOV-1916	.65	.70	9.53	10.19	
NOV-1917	.67	.73	9.40	10.36	No- 87A, 171.
NOV-1917	.97	1.06	8.19	8.93	No- 87A, 171, 176, 292.
NOV-1917	.81	.89	11.04	12.15	No- 170A, 171, 87A.
7 MONTHS NOV-1917	.80	.88	9.66	10.61	

Plaintiffs' Exhibit No. 248.

May 5, 1917.

FLOTATION OILS
of
TIMBER BUTTE MILLING CO.

	Producer.	Kind of Oil
T.B. No. 6	Georgia Pine Turpentine Co.	Crude Turpentine L.O.3
T.B. No. 10	United Naval Stores Co.	Pine Oil, M.S. No. 18
T.B. No. 12	Minerals Separation.	No. 20 Pine Oil
T.B. No. 21	Georgia Pine Turpentine Co.	Carolina Oil of Tar
T.B. No. 23	Georgia Pine Turpentine Co.	Fayetteville Wood Creosote
T.B. No. 24	Georgia Pine Turpentine Co.	Carolina Oil of Tar, Special
T.B. No. 50	United Naval Stores Co.	Pine Oil
T.B. No. 52	United Naval Stores Co.	Turpentine "C"
T.B. No. 80	Pensacola Tar & Turpentine Co.	No. 200 Wood Creosote or C P Pine Tar
T.B. No. 85	Pensacola Tar & Turpentine Co.	No. 1000-Crude Wood Oil
T.B. No. 87	Pensacola Tar & Turpentine Co.	No. 75 Crude Turpentine
T.B. No. 87 -A	Pensacola Tar & Turpentine Co.	No. 80 Pine Oil, Crude
T.B. No. 88	Pensacola Tar & Turpentine Co.	Pine Oil D.O. Pure
T.B. No. 89	Pensacola Tar & Turpentine Co.	No. 19 Pine Oil
T.B. No. 90	Mackie Pine Products Co.	No. 3 Pine Oil
T.B. No. 110	Standard Oil Company.	Cal. Richmond Fuel Oil
T.B. No. 131	Cleveland Cliffs Co.	Refined Hardwood Creosote "XX"
T.B. No. 132	Cleveland Cliffs Co.	Refined Hardwood Creosote No. 2
T.B. No. 140	C. T. Perry & Co.	Oleic Acid
T.B. No. 156	Barrett Mfg. Co.	No. 4 Coal Tar Creosote
T.B. No. 157	Barrett Mfg. Co.	Coal Tar Creosote
T.B. No. 160	Newport Turpentine & Rosin Co.	Pure S.D. Pine Oil
T.B. No. 170	General Naval Stores Co.	No. 9 Pine Tar Oil
T.B. No. 170-A	General Naval Stores Co.	No. 1214 Pine Oil
T.B. No. 171	General Naval Stores Co.	No. 5 Pure S.D. Pine Oil
T.B. No. 174	General Naval Stores Co.	No. 8 Pine Tar Oil
T.B. No. 174-A	General Naval Stores Co.	No. 814 Pine Tar Oil
T.B. No. 176	General Naval Stores Co.	No. 17 Oil, Hard Wood Creosote
T.B. No. 191	Chesapeake Oil Co.	No. 2 Pine Oil
T.B. No. 192	Chesapeake Oil Co.	No. 3 Flotation Oil—Pine Oil
T.B. No. 270	Union Oil Company.	Kerosene Acid Sludge
T.B. No. 292	C. G. Betts Company.	Refined Coal Tar

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

TIMBER BUTTE MILLING CO.

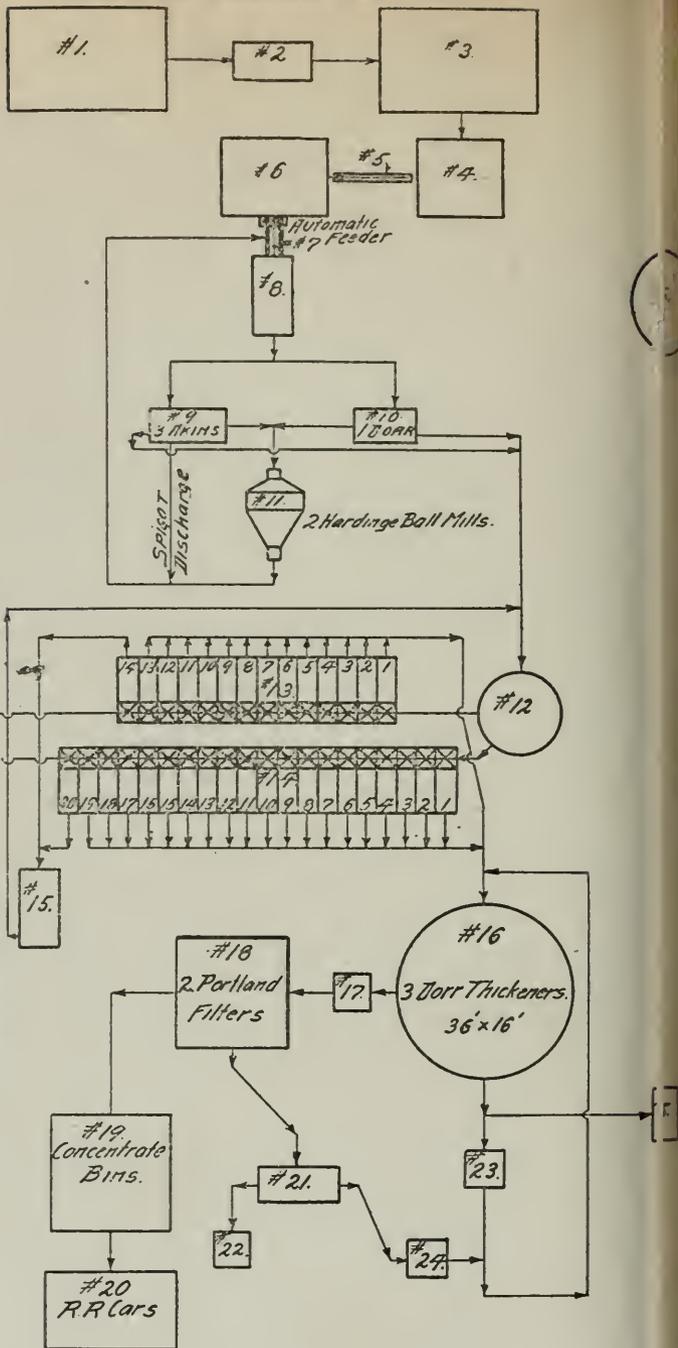
BUTTE, MONTANA.

Comparison of Yearly Metallurgical Results.

Figures Based on Mill Weights and Assays.

Date	Original Mill Feed		Gravity Concentrates				Flotation Feed		Flotation Conc.		Total Mill Tailings		Recovery of Zinc in Original Mill Feed		Estimated Recovery of Zn in Flot. Fed.			
	Tons	%	Zinc Conc.	Copper Conc.	Iron Conc.	Lead Conc.	Assay %	Tons	%	Assay %	Tons	%	Zinc %	Recovery %	Zinc %	Recovery %		
Year 1915	60461.425	17.23	18094.4235	1382.8500	3423.300	149006.6350	14.877	30406.2300	51.557	100552.5225	1.075		94.52	94.48	95.71	95.65	94.83	94.58
Year 1916	20455.0305	13.85	12112.8405	975.7205	681.7100	187677.555	12.32	35140.1825	52.550	148837.5775	.789		94.17	94.65	95.20	95.75	93.94	94.55
Jan Feb Mar 1917	41856.1680	17.426	3517.4860	2971.260	158.7295	37682.8265	14.295	9749.6000	54.474	22250.2265	.714		97.17	96.15	98.31	97.27	97.72	96.34
Year 1915-1916 Jan Feb Mar 1917	403872.640	15.131	263317.500	2652.6965	1180.7665	37370.7429	12.239	98369.1215	51.362	285938.3035	880		94.69	94.73	95.82	95.80	94.67	94.76

Filed May 18, 1917. GEO. W. SPROULE, Clerk. By H. H. WALKER, Deputy.



1. Colusa Porat Cop Tailings.
2. Electric Crane
3. R. R. Cars
4. Receiving Bin
5. Conveyor Belts
6. Storage Bin
7. Launder
8. #1 1/2 Elevator
9. 3-54" Films Cl's f's.
10. 1 - " Door "
11. 2 Hardinge Ball Mills
12. Sludge Tank.
13. 14 Cell Flot Mch.
14. 20 " " " "
15. #8 Elevator
16. 3 Dorr Thickeners
17. 2 Diaphragm Pumps
18. 2 Portland Filters
19. Concentrate Bins
20. R. R. Cars
21. Vacuum Receiver
22. " " Pump
23. Centrif. " "
24. 2 Centrif. " "
25. Worthington "
26. Tank at head of Mill

Filed May 18, 1917.
GEO. W. SPROULE,
Clerk.

By H. H. WALKER,
Deputy.

TIMBER BUTTE MILLING COMPANY
BUTTE-MONTANA.
TESTING DEPARTMENT.

FLOW SHEET NO. 2. COPPER SECTION EFFECTIVE APRIL
DRAWN BY J. FRED SMITH

APPROVED BY J. FRED SMITH

Defendant's Exhibit No. 251.

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Determinations on Magna Flotation Products for Butte & Sup. Litigation
Sample No. 3—Feed From Dorr Thickener

Weight of sample submitted to laboratory (H2O plus solids)	
Gms.	1966.00
Weight of wash water, Gms.	265.00
Weight of original feed (H2O plus solids), Gms.	1701.00
Weight of water in original feed sample, Gms.	919.00
Weight of solids in original feed sample, Gms.	782.0
Per cent solids in original feed sample.	45.97
Per cent water in original feed sample.	54.03
Pounds feed delivered per second (H2O plus solids).	28.857
Pounds feed delivered per 24 hours.	2,493,244.800
Pounds solids delivered per 24 hours.	1,146,144.630
Tons solids delivered per 24 hours.	573.072
Tons water delivered per 24 hours.	673.550

ASSAY ANALYSIS

Per cent total copper.	7.175
Per cent sulphide copper.	7.095
Per cent iron.	8.30
Per cent insoluble.	69.00

OIL ANALYSIS

Total weight of sample (Gms.)	782.0
Total weight of oil content (Gms.) ....	.1270
Pounds oil per ton. ....	.32

Page 4

NO. 2 SAMPLE (CIRCULATING PULP)

Weight of material in bottle (H2O plus solids) Gms.	2279.5
Weight of wash water.	390.0
Weight of original sample (H2O plus solids).	1889.5
Weight of original sample (Solids).	408.7
Weight of original sample (Water).	1480.8
Per cent solids in circulating pulp.	21.63
Pounds pulp circulating per 24 hours.	1,061,078.40
Pounds solids circulating per 24 hours.	229,511.26
Tons solids circulating per 24 hours.	114.756
Tons H2O circulating per 24 hours.	388.298

ASSAY ANALYSIS

Per cent total copper.	16.700
Per cent sulphide copper.	16.435
Per cent iron.	21.50
Per cent insoluble.	27.50

OIL ANALYSIS

Total weight of sample (Gms.)	408.7
Total weight of oil content (Gms.)	7.7375
Pounds oil per ton.	37.86

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Determinations on Magna Flotation Products for Butte & Superior
Litigation

NO. 6 OIL SAMPLE

(General)

Net weight oil delivered in 30 seconds (sample), Gms.....	1926.000
	Lbs..... 4.243
Pounds oil delivered per 24 hours.....	12,220.416
Pounds oil per ton ore treated.....	21.324

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-B—Machine No. 1, Spitz No. 1 Overflow

ASSAY ANALYSIS

Per cent total copper.....	19.100
Per cent sulphide copper.....	18.980
Per cent iron.....	19.40
Per cent insoluble.....	27.30

OIL ANALYSIS

Total weight of sample (Gms.).....	305.9065
Total weight of oil content (Gms.).....	63.0640
Pounds oil per ton.....	412.31

A part of this sample was lost in handling in the physical laboratory.

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1C, Machine No. 1 Spitz No. 2 Overflow

ASSAY ANALYSIS

Per cent total copper.....	21.250
Per cent sulphide copper.....	21.200
Per cent iron.....	27.15
Per cent insoluble.....	12.20

OIL ANALYSIS

Total weight of sample (Gms.).....	544.2500
Total weight of oil content (Gms.).....	26.3290
Pounds oil per ton.....	96.75

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-D—Machine No. 1, Spitz No. 3—Overflow

ASSAY ANALYSIS

Per cent total copper.....	22.200
Per cent sulphide copper.....	22.180
Per cent iron.....	27.20
Per cent insoluble.....	11.00

OIL ANALYSIS

Total weight of sample (Gms.).....	696.8030
Total weight of oil content (Gms.).....	19.4140
Pounds oil per ton.....	55.72

UTAH COPPER COMPANY

ARTHUR PLANT

EXPERIMENTAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-E, Machine No. 1, Spitz No. 4 Overflow

ASSAY ANALYSIS

Per cent total copper.....	23.000
Per cent sulphide copper.....	22.990
Per cent iron.....	26.60
Per cent insoluble.....	10.00

OIL ANALYSIS

Total weight of sample (Gms.).....	875.55
Total weight of oil content.....	12.5720
Pounds oil per ton.....	28.72

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-F—Machine No. 1, Spitz No. 5 Overflow

ASSAY ANALYSIS

Per cent total copper.....	23.900
Per cent sulphide copper.....	23.830
Per cent iron.....	26.90
Per cent insoluble.....	9.30

OIL ANALYSIS

Total weight of sample (Gms.).....	590.9970
Total weight of oil content (Gms.).....	4.8438
Pounds oil per ton.....	16.39

The oil result obtained on this sample is doubtless low on account of an explosion that took place while making the oil determination which caused some loss of sample.

Defendant's Exhibit No. 251

UTAH COPPER COMPANY**ARTHUR PLANT****METALLURGICAL AND RESEARCH DEPARTMENT**

Magna Sample No. 1-G—Machine No. 1—Spitz No. 6 Overflow

ASSAY ANALYSIS

Per cent total copper.....	23.800
Per cent sulphide copper.....	23.790
Per cent iron.....	26.20
Per cent insoluble.....	11.00

OIL ANALYSIS

Total weight of sample (Gms.).....	397.2760
Total weight of oil content (Gms.).....	5.2463
Pounds oil per ton.....	26.41

UTAH COPPER COMPANY**ARTHUR PLANT****METALLURGICAL AND RESEARCH DEPARTMENT**Magna Sample No. 8-B, Machine No. 1—Spitz No. 10—Dark Color
Oily Concentrate**ASSAY ANALYSIS**

Per cent total copper.....	18.800
Per cent sulphide copper.....	18.480
Per cent iron.....	16.30
Per cent insoluble.....	32.10

OIL ANALYSIS

Total weight of sample (Gms.).....	28.9530
Total weight of oil content (Gms.).....	2.6630
Pounds oil per ton.....	183.95

UTAH COPPER COMPANY**ARTHUR PLANT****METALLURGICAL AND RESEARCH DEPARTMENT**Magna Sample No. 8-A—Machine No. 1—Spitz No. 10—Light
Color Froth**ASSAY ANALYSIS**

Per cent total copper.....	12.250
Per cent sulphide copper.....	11.970
Per cent iron.....	11.40
Per cent insoluble.....	49.70

OIL ANALYSIS

Total weight of sample (Gms.).....	19.3450
Total weight of oil content (Gms.).....	.6570
Pounds oil per ton.....	67.94

Defendant's Exhibit No. 251

UTAH COPPER COMPANY

ARTHUR PLANT

METALLURGICAL AND RESEARCH DEPARTMENT

Magna Sample No. 1-A—Machine No. 1 Combined Concentrate

ASSAY ANALYSIS

Per cent total copper.....	25.650
Per cent sulphide copper.....	25.570
Per cent iron.....	22.40
Per cent insoluble.....	15.40

OIL ANALYSIS

Total weight of sample (Gms.).....	493.9315
Total weight of oil content (Gms.).....	11.5778
Pounds oil per ton.....	46.88

NO. 11 TAILING SAMPLE (CUT NO. 1)

Weight of material in bottle (original sample and wash H ₂ O) Gms.	2893.0
Weight of wash water, Gms.....	130.0
Weight of original sample, Gms.....	2763.0
Weight of H ₂ O decanted, Gms.....	1979.0
Weight of residual pulp, Gms.....	914.0
Weight of solids in residual pulp, Gms.....	681.5
Weight of H ₂ O in residual pulp, Gms.....	232.5
Total weight of H ₂ O in original sample.....	2081.5
Per cent solids in original sample.....	24.67

ASSAY ANALYSIS

Per cent total copper.....	.165
Per cent sulphide copper.....	.140
Per cent iron.....	1.85
Per cent insoluble.....	90.80

OIL ANALYSIS

Total weight of sample (Gms.).....	681.50
Total weight of oil content (Gms.).....	2.2480
Pounds oil per ton.....	6.60

NO. 11 TAILING SAMPLE (CUT NO. 2)

Weight of material in bottle (original sample and wash H ₂ O), Gms.	2841.6
Weight of wash water, Gms.....	100.0
Weight of original sample.....	2741.6
Weight of H ₂ O decanted, Gms.....	1937.0
Weight of residual pulp, Gms.....	914.6
Weight of solids in residual pulp, Gms.....	673.0
Weight of H ₂ O in residual pulp, Gms.....	241.6
Total weight of H ₂ O in original sample, Gms.....	2078.6
Per cent solids in original sample.....	24.55

ASSAY ANALYSIS

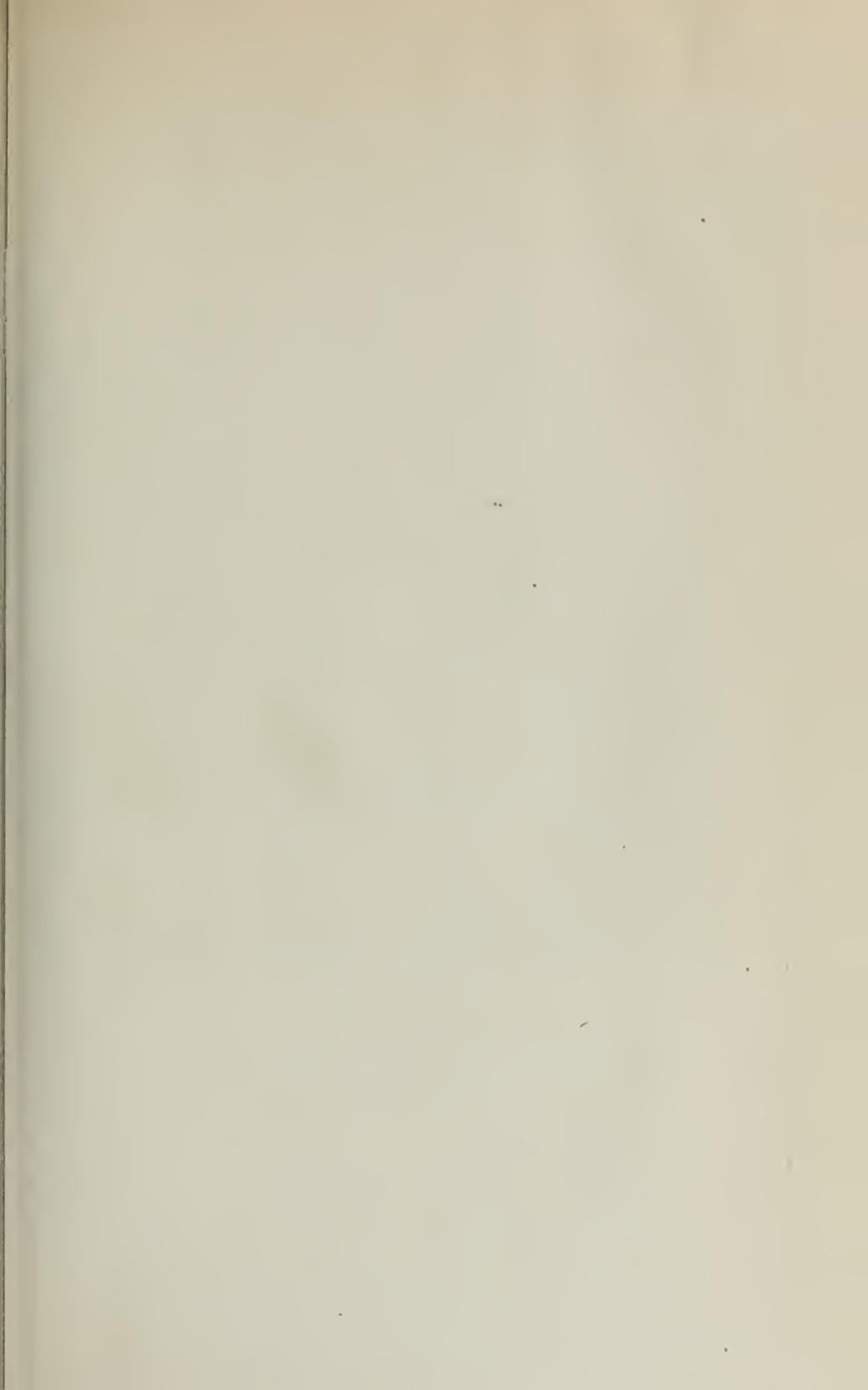
Per cent total copper.....	.155
Per cent sulphide copper.....	.130
Per cent iron.....	1.80
Per cent insoluble.....	88.00

OIL ANALYSIS

Total weight of sample (Gms.).....	673.0
Total weight of oil content (Gms.).....	1.9345
Pounds oil per ton.....	5.75

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.



Plaintiff's

BUTTERFIELD
VISIT OF MINERALS
TESTS

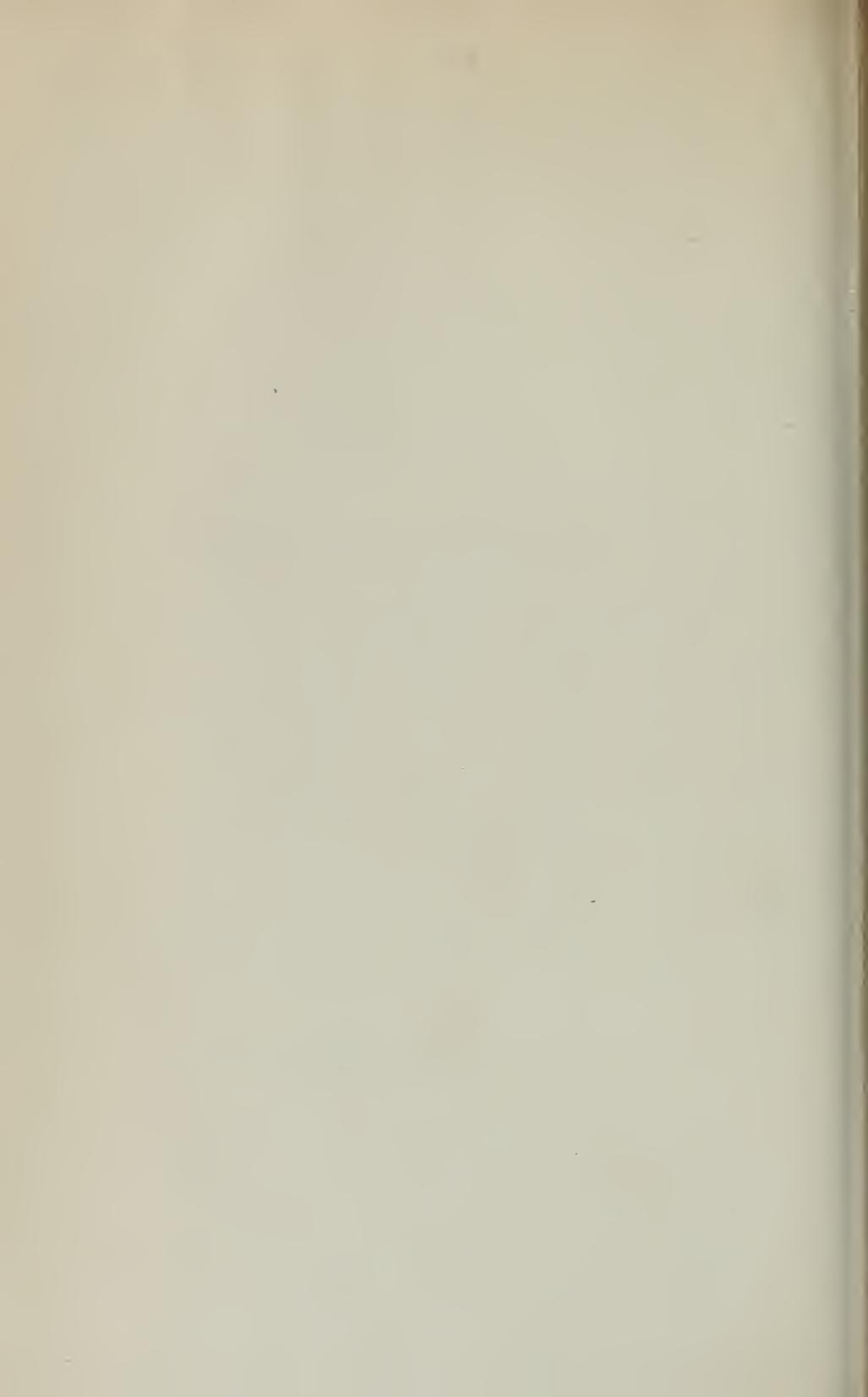
PRODUCT	DRY WEIGHT		Assay %
	Total in 4 hr. Tons.	Per cent of Heads	
Concentrates Sharps.....	31.37	11.9	46.9
Concentrates Slimes.....	28.79	10.9	41.8
Concentrates Total.....	60.16	22.8	44.5
Concentrates from B. & S. figures.....	(60.16)		(45.2)
Tailings Sharps.....	111.40	42.3	1.49
Tailings Slimes.....	91.97	34.9	1.91
Tailings Total.....	203.37	77.2	1.68
Tailings from B. & S. figures.....			(1.57)
Heads Calc' (Conc. plus Tails).....	263.53	100.00	11.44
from B. & S. figures.....	(263.53)		(11.53)

. 252.

MILL
 RTY APRIL 29TH, 1917
 P. M.

VOLATILE OILS RECOVERED		VOLATILE OILS RECOVERED		NON-VOLATILE OILS RECOVERED	
Lbs. per ton of Product	Per cent of total Oil Feed in 4 hours	Lbs. per Ton of Product	Per cent of total Volatile Oil recovered in Concts. and Tails	Lbs. per Ton of Product	Per cent of Total Non-Volatile Oil Recovered
22.8	10.5	10.6	12.29	12.2	10.80
93.4	39.5	49.2	52.34	44.2	35.89
<u>56.6</u>	<u>50.0</u>	<u>29.1</u>	<u>64.63</u>	<u>27.5</u>	<u>46.69</u>
(62.6)	(54.2)				
0.296	0.5	0.172	0.71	0.124	0.39
30.6	41.3	10.2	34.66	20.4	52.92
<u>14.00</u>	<u>41.7</u>	<u>4.7</u>	<u>35.37</u>	<u>9.3</u>	<u>53.31</u>
(13.4)	(39.2)				
23.7	91.7	10.3	100.0	13.4	100.0
(24.63)	(93.4)				

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.



Plaintiffs' Exhibit No. 253.

UTAH COPPER SAMPLES

% Copper	Weights of Products Calculated From Assays		Indicated Copper Recovery	Oil % upon Products	- Recovery of oil fed 1.00% or 21.15 lbs. per ton
	Ton	Unit			
Heads	7.4	2000 lb.			
Concentrates	26.3	550 lb.	97.9%	Vol .67%	
				Non V. 2.14	73.1%
				Total 2.81	
Tailings .....	.2	1450 lb.		Vol. .039%	
				Non V. .160	13.6%
				Total	.199
Total					86.7%
Skimmings					
1st. Spitzkas-					
ten	19.7			Total oil	
				26.24%	
Concentrates					
from 2nd					
Spitzkasten	21.75			Total oil	
				4.87%	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

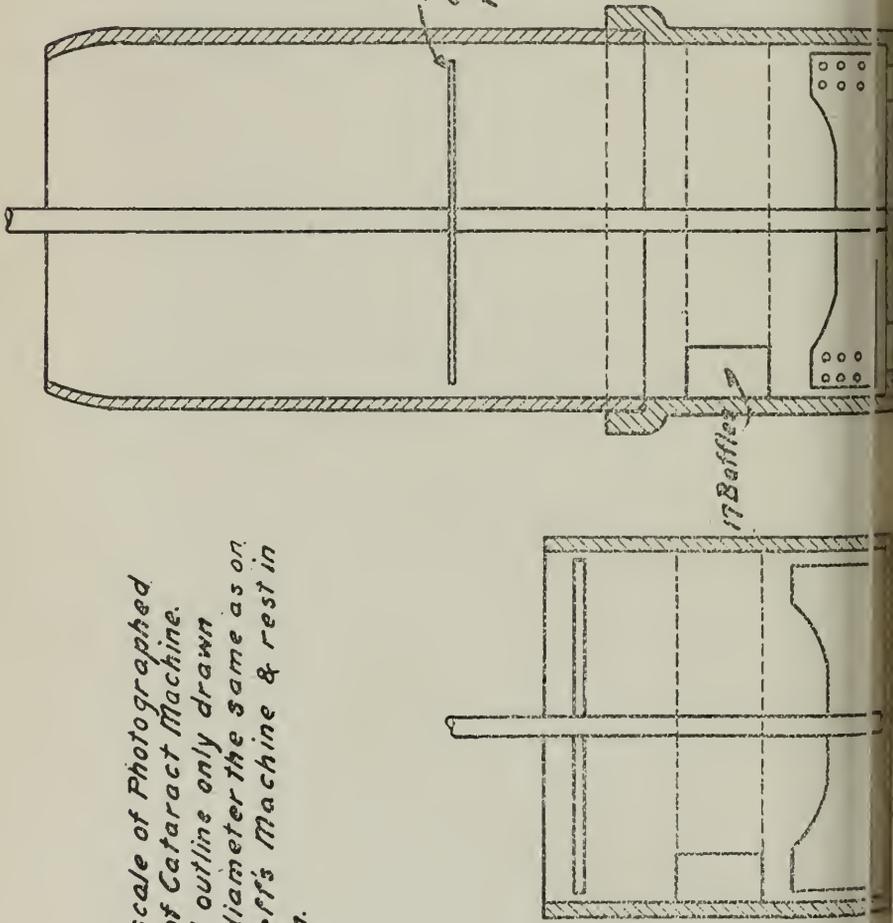
Cataract Machine

May 3, 1917

Scale 6 = 1 Ft.

Copy to scale of Photographed picture of Cataract Machine. Internal outline only drawn. Inside diameter the same as on Divg. of Deff's Machine & rest in proportion.

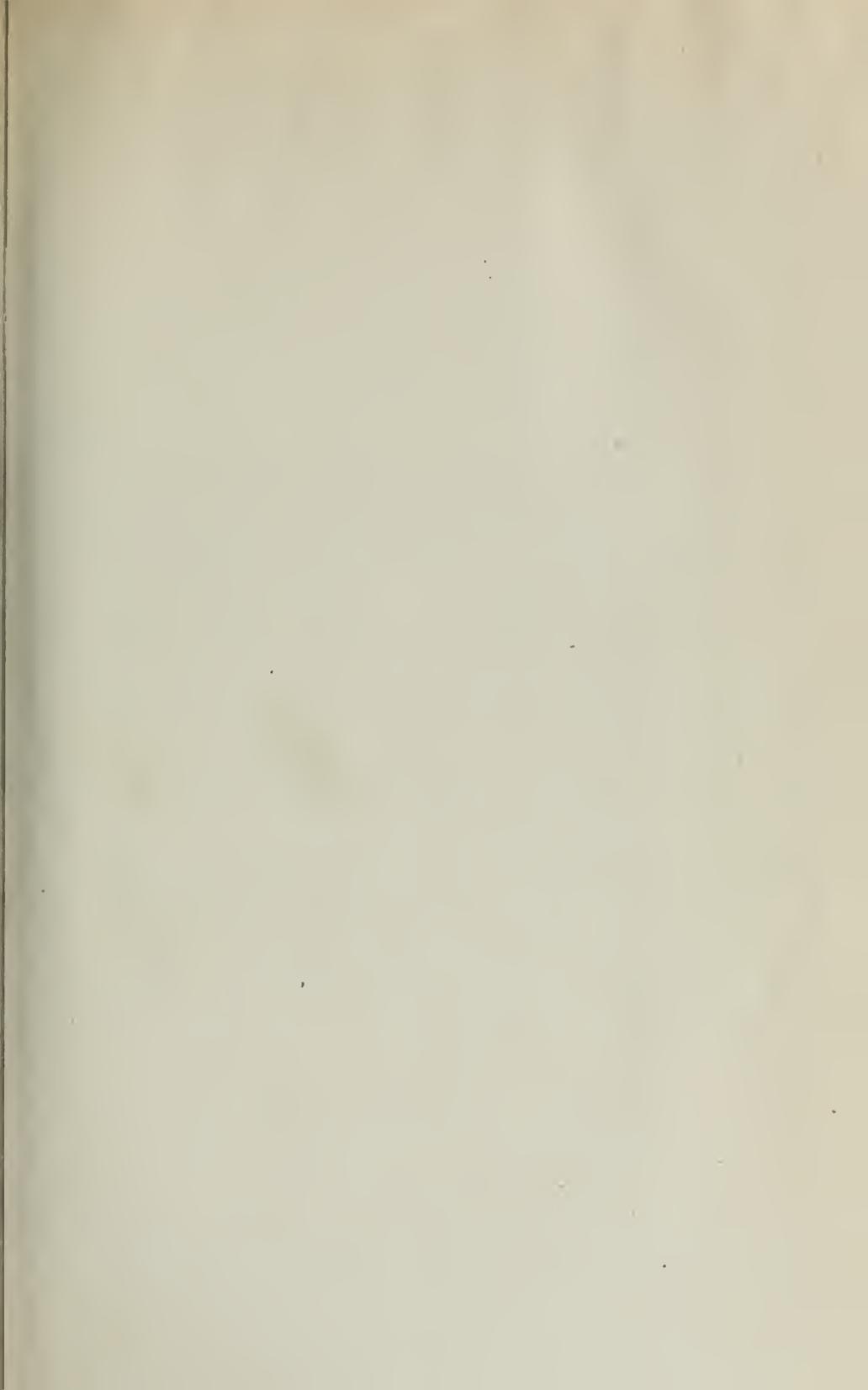
Position of this cover adjustable, but it was partly rusted into position as shown.



Filed May 18, 1917.

GEO. W. SPROULE, Clk.

By H. H. WALKER, D. ut



MINERALS SEPARATION

Referring to Defective

Period	Heading to Flotation			Ratio of Concentration	Flotation Concentrates			Recovery % Cu.		
	Tons	Assay % Cu.	Contents Lbs. Cu.		Tons	Assay % Cu.	Contents Lbs. of Cu.	Calculated By Contents	Given in Exh. 29	To By fere
1916 3rd Quarter....	26804	7.01	3757921	3.94	6804	27.10	3687768	98.13	96.717	2 0
1916 October.....	9794	7.77	1521988	3.40	2884	26.03	1501410	98.65	98.17	
1916 Nov. 18, 19. 20	561	10.24	114693	2.95	190	29.28	111254	96.84	98.437	

airiff's Exhibit No. 255.

LIMITED ET AL. VS. BUTTE & SUPERIOR MINING CO.

29 Chino Copper Company—Retreatment of Vanner Concentrates.

Mr. Wick's Evidence Q. 25 and Q. 26.

Assay % Cu.		Loss of Cu. in Tailings per ton of Heading		Cost of Smelting Concentrate			Cost of Concentration		Total Increase of cost per ton of Heading	Oil Lbs. per ton of Heading	Other Reagents Lbs. per ton of Heading
		Lbs.	Value if one lb. cu. in conc. be worth 20c net to the Mill	Smelting Charge & Freight per ton of Concentrate	Total	Per ton of Heading to Flotation	Operating per ton of Heading	Cost per ton of Heading including loss in tails and Cost of Smelting			
0.175	.306	2.62	\$ 0.524	\$ 6.00	\$ 40824	\$ 1.523	a	a + 0.524 + 1.523 = a + 2.047	8.76	4.57	
.149	.200	2.10	0.420	"	17304	1.767	a	a + 0.420 + 1.767 a + 2.187	10.26	4.77	
.489	.244	6.47	1.294	"	1140	2.032	a + 15 for (Extra Oil) &c.	a + 0.15 + 1.294 + 2.032 = a + 3.476	23.70	6.34	

Filed May 18, 1917

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

MINERALS SEPARATION LIMITED ET AL. VS. BUTTE AND SUPERIOR MINING CO.

Referring to Defendant's Exhibit No. 150. Ray Coal

Period	Heading to Flotation			Ratio of Concentration	Flotation Concentrate			Recovery	
	Tons	Assay Cu. %	Contents Lbs. Cu.		Tons	Assay Cu. %	Contents Lbs. Cu.	Calculated	% Cu. Given Exh. 150
1916 4th Quartr.	27275	6.099	3527005	4.48	6086	26.38	3210974	96.51	96.51
1917 1st Quartr...	28913	6.531	3776812	3.64	7933	22.76	3592556	95.12	95.42

NOTE.—There would also be an additional smelting loss in the second case owing to the lar

Exhibit No. 256.

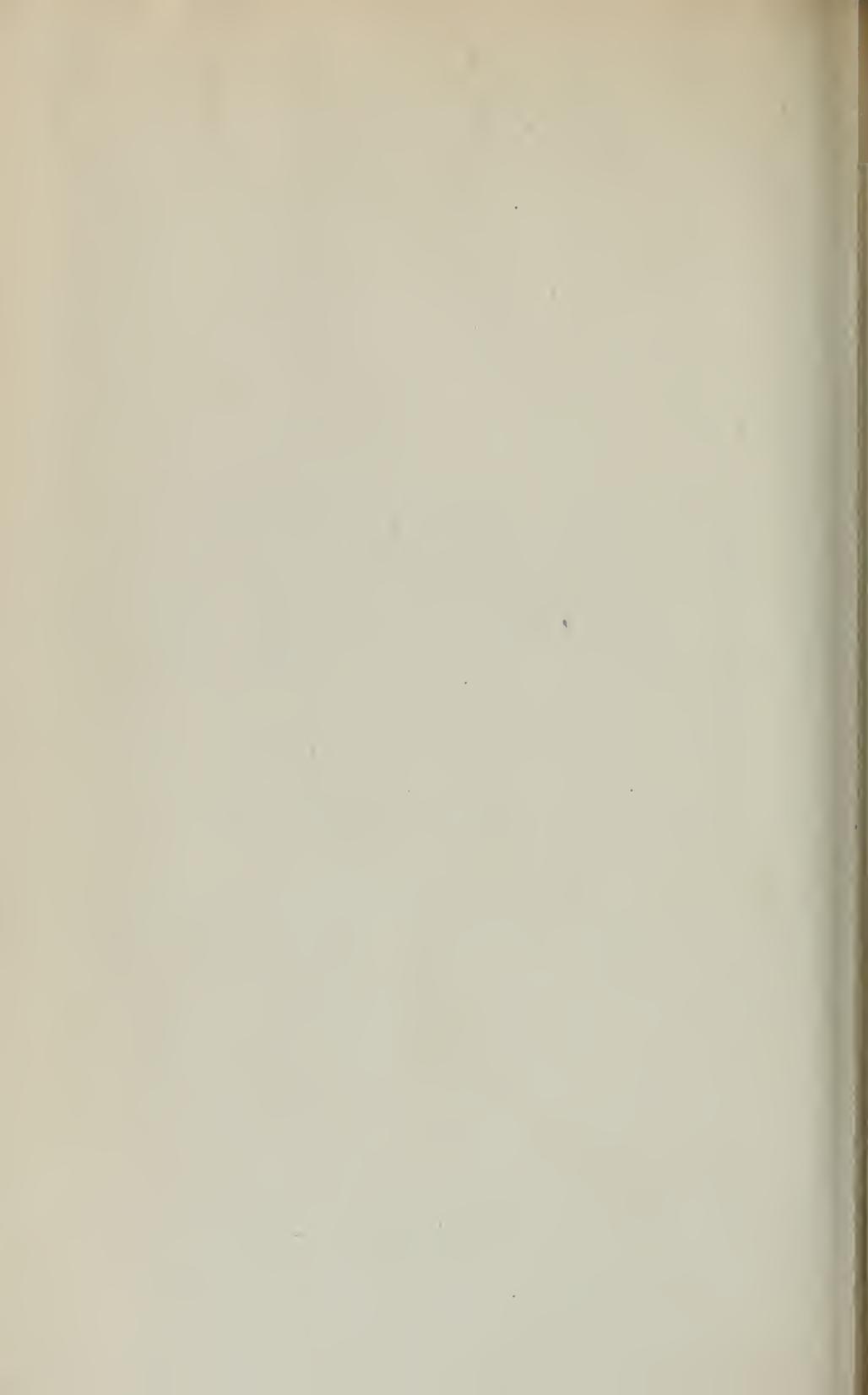
Retreatment of Vanner Concentrates Products. Mr. Engelmann's Evidence, Q. 32-37 and Q. 84.

Assay Cu %		Loss of Cu. in Tailings p. ton of Heading		Cost of Smelting Concentrates			Cost of Concentration			Oil lbs. per ton of Heading	Other Reagents Lbs. per ton of Heading
Calculated	Given Exh. 150	Lbs.	If one lb. of copper in Concentrate be worth 20c net to the mill.	Smelting charge per ton of Concentrate	Total	Per Ton of Heading	Operating per ton of Heading	Total cost per ton of heading including loss in tails and Smelting charge	Total in- crease of cost per ton of Heading in 1st Q. 1917		
0.274	0.273	4.25	0.85	\$ 5.00	\$ 30430	1.12	\$ a	$a + 65 + 1.12$ $= a + 2.99$	\$	3.54	
0.439	0.413	6.37	1.27	5.00	39665	1.37	a + 0.15 (For extra oil)	$a + .15 + .127 + 1.37$ $= a + 2.79$	0.82	20.10	

lagade.

Filed May 18, 1917.

GEORGE W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Plaintiffs' Exhibit No. 257.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERAL SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR
COPPER COMPANY,
LIMITED.

Defendant.

IN EQUITY

STATEMENT OF BUTTE AND SUPERIOR COP-
PER COMPANY, LIMITED, FOR THE MONTH
OF JANUARY, 1916, FILED PURSUANT TO
ORDER OF COURT ENTERED IN ABOVE EN-
TITLED ACTION ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Copper Company,
Limited, and in compliance with the order of court
entered in the above entitled cause on the 15th day of
November, 1913, files the following statement showing
an approximate estimate for the month of January,
1916.

Plaintiffs' Exhibit No. 257

1. Of the amount of ore treated in its oil flotation plant.....49428.060 Tons
2. Of the amount of concentrates recovered in its oil flotation plant..10535.210 "
3. Of the analysis and assay returns of heads in its ^{oil} flotation plant

12.4956%	Zn.
.7744%	Pb.
.238%	Cu.
1.3536%	Fe.
1.4154%	Mn.
73.1557%	Insol.
5.3859 Oz.	Ag.
.0112 "	Au
4. Of the analysis and assay returns of concentrates recovered in its oil flotation ^{plant}.....

54.593%	Zn.
2.991%	Pb.
.620%	Cu.
2.137%	Fe.
.249%	Mn.
8.580%	Insol.
23.057	Oz. Ag.
.0330	Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant\$ 3.0583
6. Of the value per ton of concentrates recovered in its oil flotation plant.....\$101.164

Plaintiffs' Exhibit No. 257

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are

accurate and not estimates...

1.2008%	Zn.
.0500%	Pb.
.065	% Cu.
.8300%	Fe.
1.5500%	Mn.
90.48	% Insol.
1.0600	Oz. Ag.
.00208	" Au.

Plaintiffs' Exhibit No. 257

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior
Copper Company, Limited, and makes this affidavit
for and on its behalf; that he has read the foregoing
statement and knows the contents thereof; that the
approximate estimates therein set forth are true to
the best of his knowledge, information and belief; that
such approximate estimates in said report are set forth
under paragraphs 1 to 6 inclusive; that as to the
analysis and assay returns of this from the oil flotation
plant under paragraph 7 of said statement, the same
is not an approximate estimate, but that the percentages
and weights contained in the answer thereto are accur-
ate, to the best of his knowledge, information and be-
lief.

CHAS. BOCKING

February, 1916.

Subscribed and sworn to before me this
19th day of February, 1916.

C. K. TUOHY,

Notary Public for the State of Mon-
tana, residing at Butte, Montana.

My commission expires July 7, 1918.

(SEAL.)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiff's Exhibit No. 258.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERAL SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR
COPPER COMPANY,
LIMITED,

Defendant.

IN EQUITY

STATEMENT OF BUTTE AND SUPERIOR COP-
PER COMPANY, LIMITED, FOR THE MONTH
OF FEBRUARY, 1916, FILED PURSUANT TO
ORDER OF COURT ENTERED IN THE
ABOVE ENTITLED ACTION ON NOVEMBER
15th, 1913.³

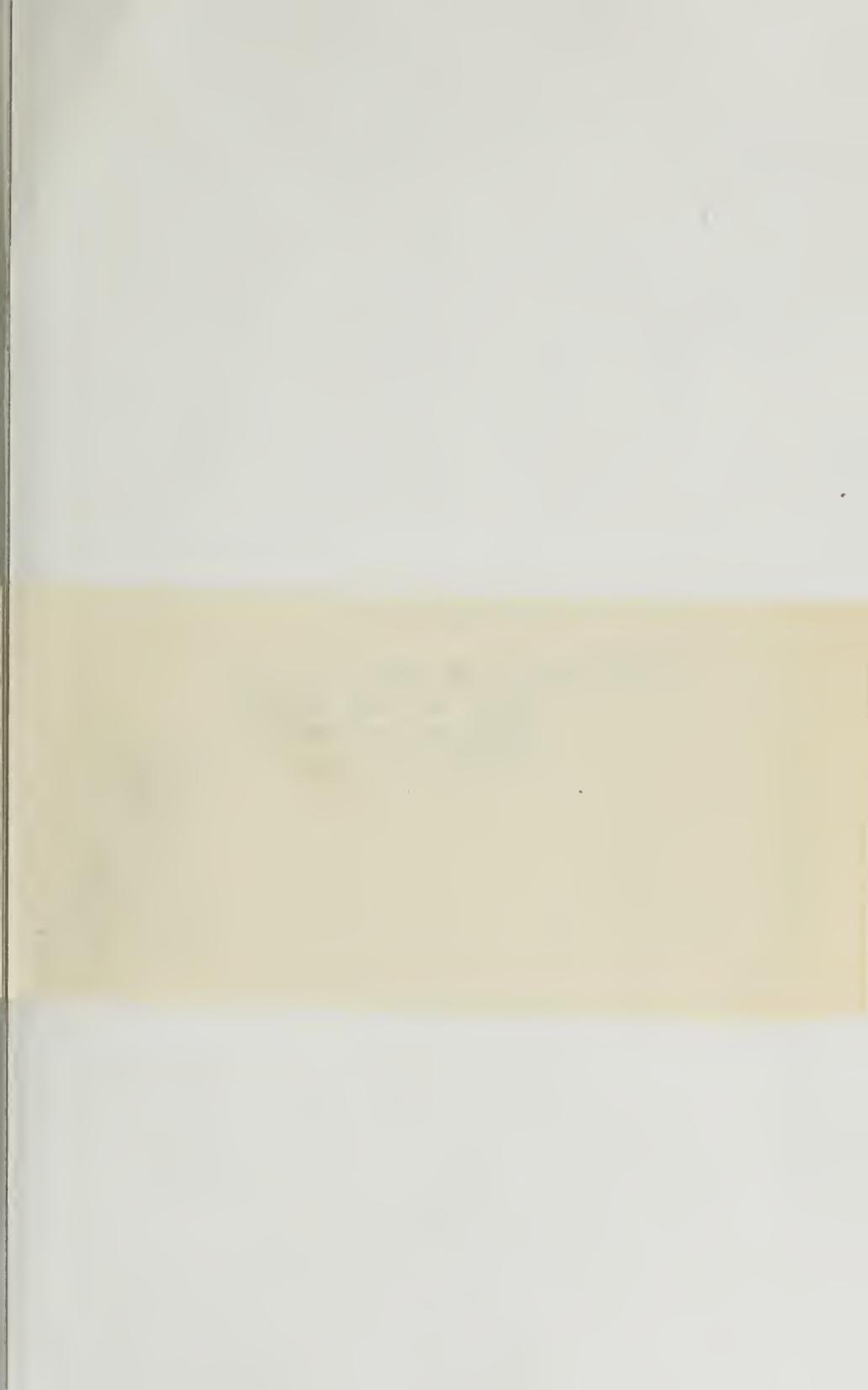
Comes now Butte and Superior Copper Company,
Limited, and in compliance with the order of court
entered in the above entitled cause on the 15th day of
November, 1913, files the following statement showing
an approximate estimate for the month of February,
1916.

Plaintiffs' Exhibit No. 258

1. Of the amount of ore treated in its oil flotation plant..... 49,800.276 Tons
2. Of the amount of concentrates recovered in its oil flotation plant 10,774.997 "
3. Of the analysis and assay returns of heads in its oil flotation plant

11.8580%	Zn.
.7534%	Pb.
.1645%	Cu.
1.3998%	Fe.
1.2018%	Mn.
71.6222%	Insol.
5.7921	Oz. Ag.
.00956	Oz. Au.
- 5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant..\$2.5271
6. Of the value per ton of concentrates recovered in its oil flotation plant.....\$93.567

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.



ons

P. 5380, After line 16 insert: " 4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant.....

53.940%	Zn.
2.956%	Pb.
.627%	Cu.
2.069%	Fe.
.273%	Mn.
9.293%	Insol.
23.016	Oz. Ag.
.0338	Oz. Au.

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Butte
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Plaintiffs' Exhibit No. 258

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate and not estimates

1.5034% Zn.
.0800% Pb.
.0450% Cu.
.8500% Fe.
1.500 % Mn.
90.59 % Insol.
1.0100 Oz. Ag.
.00209 Oz. Au.

Plaintiffs' Exhibit No. 258

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of
February, 1916.

ALF. C. KREMER,

Notary public for the State of Montana, residing at
Butte, Montana.

My commission expires Sept. 5, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 259.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERAL SEPARATION,
LIMITED,

Plaintiff,
vs.

IN EQUITY.

BUTTE & SUPERIOR COPPER
COMPANY, LIMITED,
Defendant.

STATEMENT OF BUTTE AND SUPERIOR COP-
PER COMPANY, LIMITED, FOR THE MONTH
OF MARCH, 1916, FILED PURSUANT TO OR-
DER OF COURT ENTERED IN THE ABOVE
ENTITLED ACTION ON NOVEMBER 15TH,
1913.

Comes now Butte and Superior Copper Company,
Limited, and in compliance with the order of court en-
tered in the above entitled cause on the 15th day of No-
vember, 1913, files the following statement showing an
approximate estimate for the month of March, 1916.

Plaintiffs' Exhibit No. 259

1. Of the amount of ore treated in its
oil flotation plant52,089,4335 Tons
2. Of the amount of concentrates re-
covered in its oil flotation plant.12,199.0195 “
3. Of the analysis and assay returns
of heads in its oil flotation
plant13.7634% Zn.
.7238% Pb.
.1572% Cu.
1.2916% Fe.
1.2720% Mn.
71.7590% Insol.
5.8663 Oz. Ag.
.0089 Oz. Au.
4. Of the analysis and assay returns
of concentrates recovered in its
oil flotation53.752% Zn.
3.046% Pb.
.598% Cu.
1.971% Fe.
.295% Mn.
10.107% Insol.
23.388 Oz. Ag.
.0347 Oz. Au.
5. Of the cost of flotation per ton of con-
centrates recovered in its oil flotation
plant\$ 2.6968
6. Of the value per ton of concentrates re-
covered in its oil flotation plant.....\$93.627

P. 5385, L. 16, Insert " 90.4000% Insol."



Plaintiffs' Exhibit No. 259

The figures set forth under the foregoing six paragraphs are as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures

are accurate and not estimates

1.3138%	Zn.
.0600%	Pb.
.0330%	Cu.
.8400%	Fe.
1.5300%	Mn.
.9700	Oz. Ag.
.0025	Oz. Au.

Plaintiffs' Exhibit No. 259

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the cashier of the Butte and Superior Copper Company, Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages of weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day
of April, 1916.

ALF C. KREMER,
Notary Public for the State of Montana, residing at
Butte, Montana.

My commision expires Sept. 5, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 260.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERAL SEPARATION,
LIMITED,

Plaintiff,

vs.

IN EQUITY.

BUTTE & SUPERIOR COP-
PER COMPANY, LIMITED,
Defendant.

STATEMENT OF BUTTE AND SUPERIOR COP-
PER COMPANY, LIMITED, FOR THE MONTH
OF APRIL, 1916, FILED PURSUANT TO OR-
DER OF COURT ENTERED IN ABOVE EN-
TITLED CAUSE ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Copper Company,
Limited, and in compliance with the order of court
entered in the above entitled cause on the 15th day
of November, 1913, files the following statement show-
ing an approximate estimate for the month of April,
1916:

Plaintiffs' Exhibit No. 260

1. Of the amount of ore treated in its oil flotation plant50,115.6675 Tons
2. Of the amount of concentrates recovered in its oil flotation plant.12,080.5145 tons
3. Of the analysis and assay returns of heads in its ^{oil} flotation plant

14.0828% Zn.
.8599% Pb.
.1936% Cu.
1.2723% Fe.
1.3087% Mn.
71.5644% Insol.
6.2552 Oz. Ag.
.0107 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation ^{plant}

53.353% Zn.
3.311% Pb.
.558% Cu.
2.043% Fe.
.352% Mn.
10.355% Insol.
23.713 Oz. Ag.
.0347 Oz. Au.
5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant \$ 2.8430
6. Of the value per ton of concentrates recovered in its oil flotation plant..... 83.7990

The figures set forth under the foregoing six para-

Plaintiffs' Exhibit No. 260

graphs are as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures

are accurate and not estimates..1.3810% Zn.

.0800% Pb.

.0400% Cu.

.7500% Fe.

1.4500% Mn.

91.1000% Insol.

.9200 Oz. Ag.

.00208 Oz. Au.

Plaintiffs' Exhibit No. 260

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the cashier of the Butte and Superior Copper Company Limited, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 19th day
of May, 1916.

C. K. TUOHY,
Notary Public for the State of Montana, residing at
Butte, Montana.

My commission expires July 7th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 261.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR
COPPER COMPANY,
LIMITED,

Defendant.

IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR COP-
PER COMPANY LIMITED (NOW BUTTE
AND SUPERIOR MINING COMPANY) FOR
THE MONTH OF MAY, 1916, FILED PURSU-
ANT TO ORDER OF COURT ENTERED IN
THE ABOVE ENTITLED CAUSE ON NO-
VEMBER 15TH, 1913.

Comes now Butte and Superior Copper Company,
Limited (now Butte and Superior Mining Company),
and in compliance with the order of court entered in
the above entitled cause on the 15th day of November,

Plaintiffs' Exhibit No. 261

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant. \$ 3.2337
6. Of the value per ton of concentrates recovered in its oil flotation plant.....\$65.27

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures

are accurate and not estimates

1.3509%	Zn.
.0600%	Pb.
.0500%	Cu.
.7800%	Fe.
1.5500%	Mn.
90.1400%	Insol.
.8800	Oz. Ag.
.0033	Oz. Au.

Plaintiffs' Exhibit No. 261

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the cashier of the Butte and Superior Copper Company, Limited (now Butte and Superior Mining Company), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 19th day
of June, 1916.

A. C. KREMER,
Notary Public for the State of Montana, residing at
Butte, Montana.

My commission expires Sept. 5th, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 262.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERAL SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR
MINING COMPANY,
formerly BUTTE & SU-
PERIOR COPPER COM-
PANY, LIMITED,

Defendant.

NO. 6
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY (FORMERLY BUTTE AND
SUPERIOR COPPER COMPANY, LIMITED)
FOR THE MONTH OF JUNE, 1916, FILED
PURSUANT TO ORDER OF COURT EN-
TERED IN THE ABOVE ENTITLED CAUSE
ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Mining Company
(formerly Butte and Superior Copper Company, Lim-
ited), and in compliance with the order of Court en-

Plaintiffs' Exhibit No. 262

5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant \$ 3.2105
6. Of the value per ton of concentrates recovered in its oil flotation plant.....\$49.44

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate and not estimates
- | | |
|--|-----------------|
| | 1.0766% Zn. |
| | .0800% Pb. |
| | .0400% Cu. |
| | .7500% Fe. |
| | 1.7000% Mn. |
| | 88.5500% Insol. |
| | .7300 Oz. Ag. |
| | .0025 Oz. Au. |

Plaintiffs' Exhibit No. 262

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the cashier of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited) and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this 20th day of
July, 1916.

A. C. KREMER,

Notary Public for the State of Montana, residing at
Butte, Montana.

My commission expires Sept. 5th, 1916.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 263.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR
MINING COMPANY,
formerly BUTTE & SU-
PERIOR COPPER COM-
PANY, LIMITED,

Defendant.

NO. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY (FORMERLY BUTTE AND
SUPERIOR COPPER COMPANY, LIMITED)
FOR THE MONTH OF JULY, 1916, FILED
PURSUANT TO ORDER OF COURT EN-
TERED IN THE ABOVE ENTITLED CAUSE
ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Mining Company
(formerly Butte and Superior Copper Company, Lim-
ited), and in compliance with the order of Court en-
tered in the above entitled cause on the 15th day of

Plaintiffs' Exhibit No. 263

November, 1913, files the following statement showing an approximate estimate for the month of July, 1916:

1. Of the amount of ore treated in
its oil flotation plant45,874.287 Tons.
2. Of the amount of concentrates re-
covered in its oil flotation plant 8,685.416 “
3. Of the analysis and assay returns
of heads in its ^{oil} flotation plant..11.4907% Zn.
.8030% Pb.
.1427% Cu.
1.6479% Fe.
1.8797% Mn.
73.6796% Insol.
4.6771 Oz. Ag.
.0082 Oz. Au.
4. Of the analysis and assay returns
of concentrates recovered in its
oil flotation54.000% Zn.
3.168% Pb.
.611% Cu.
2.180% Fe.
.329% Mn.
8.706% Insol.
23.161 Oz. Ag.
.030 Oz. Au.
5. Of the cost of flotation per ton of concen-
trates recovered in its oil flotation
plant \$ 3.64

Plaintiffs' Exhibit No. 263

6. Of the value per ton of concentrates re-
covered in its oil flotation plant.....\$48.83

The figures set forth under the foregoing six paragraphs are, as noted, approximately estimates, for the season that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay re-
turns of tails from the oil flota-
tion plant the following figures

are accurate and not estimates

1.0760%	Zn.
.0600%	Pb.
.0300%	Cu.
.7600%	Fe.
2.0000%	Mn.
89.8400%	Insol.
.7400	Oz. Ag.
.00208	Oz. Au.

Plaintiffs' Exhibit No. 263

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the cashier of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this.....day
of August, 1916.

Notary Public for the State of Montana, residing at
Butte, Montana.

My commission expires

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 264.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED

Plaintiff,

vs.

BUTTE & SUPERIOR
MINING COMPANY,
formerly BUTTE & SU-
PERIOR COPPER COM-
PANY, LIMITED,

Defendant.

NO. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY (FORMERLY BUTTE AND
SUPERIOR COPPER COMPANY, LIMITED)
FOR THE MONTH OF AUGUST, 1916, FILED
PURSUANT TO ORDER OF COURT EN-
TERED IN THE ABOVE ENTITLED CAUSE
ON NOVEMBER 15TH, 1913.

Comes now Butte and Superior Mining Company
(formerly Butte and Superior Copper Company, Lim-
ited) and in compliance with the order of Court en-
tered in the above entitled cause on the 15th day of

Plaintiffs' Exhibit No. 264

November, 1913, files the following statement, showing an approximate estimate for the month of August, 1916:

1. Of the amount of ore treated in
its oil flotation plant31,733.120 Tons.
2. Of the amount of concentrates
recovered in its oil flotation
plant 7,502.243 "
3. Of the analysis and assay returns
of heads in its ^{oil} flotation plant....13.4892% Zn.
.7759% Pb.
.1603% Cu.
1.7436% Fe.
1.8357% Mn.
70.3365% Insol.
6.2148 Oz. Ag.
.0089 Oz. Au.
4. Of the analysis and assay returns
of concentrates recovered in its
oil flotation ^{plant}54.290% Zn.
2.912% Pb.
.575% Cu.
2.322% Fe.
.310% Mn.
8.862% Insol.
23.117 Oz. Ag.
.040 Oz. Au.
5. Of the cost of flotation per ton of concen-
trates recovered in its oil flotation plant \$ 4.8860

Plaintiffs' Exhibit No. 264

6. Of the value per ton of concentrates recovered in its oil flotation plant..... 49.4500

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant the following figures are accurate, and not estimates

.....	1.0000%	Zn.
	.0600%	Pb.
	.0200%	Cu.
	.5600%	Fe.
	1.8500%	Mn.
	90.5900%	Insol.
	.8300	Oz. Ag.
	.0013	Oz. Au.

Plaintiffs' Exhibit No. 264

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA—ss.

J. L. BRUCE, being first duly sworn on oath, deposes and says:

That he is the Manager of the Butte and Superior Mining Company (formerly Butte and Superior Copper Company, Limited), and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that such approximate estimates in said report are set forth under paragraphs 1 to 6 inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

J. L. BRUCE.

Subscribed and sworn to before me this.....day
of September, 1916.

LOUIS P. SANDERS,
Notary Public for the State of Montana, residing at
Butte, Montana.

My commission expires July 14th, 1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 265.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff

vs.

No. 8

BUTTE & SUPERIOR MIN-
ING COMPANY, Formerly
BUTTE & SUPERIOR
COPPER COMPANY,
LIMITED,

Defendant.

IN EQUITY

STATEMENT OF BUTTE AND SUPERIOR
MINING COMPANY (FORMERLY BUTTE
AND SUPERIOR COPPER COMPANY, LIMIT-
ED) FOR THE MONTH OF SEPTEMBER, 1916,
FILED PURSUANT TO ORDER OF COURT
ENTERED IN THE ABOVE ENTITLED
CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company
(formerly Butte and Superior Copper Company,
Limited) and in compliance with the order of Court
entered in the above entitled cause on the 15th day
of November, 1913, files the following statement, show-

Plaintiffs' Exhibit No. 265

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates

1.0900%	Zn.
.0600%	Pb.
.0800%	Cu.
.8000%	Fe.
2.0000%	Mn.
88.4000%	Insol.
.7900	Oz. Ag.
.0020	Oz. Au.

Plaintiffs' Exhibit No. 265

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof: that the approximate estimates therein set forth are true to the best of his knowledge, information and belief: that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive: that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me this
20th day of October, 1916.

ALF C. KREMER,
Notary Public for the State of Mon-
tana, residing at Butte, Montana.
My commission expires October 2nd,
1919.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 266.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR MIN-
ING COMPANY, Formerly
BUTTE & SUPERIOR
COPPER COMPANY, LIM-
ITED,

Defendant.

No. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR
MINING COMPANY (FORMERLY BUTTE
AND SUPERIOR COPPER COMPANY, LIMIT-
ED) FOR THE MONTH OF OCTOBER, 1916,
FILED PURSUANT TO ORDER OF COURT
ENTERED IN THE ABOVE ENTITLED
CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company
(formerly Butte and Superior Copper Company,
Limited) and in compliance with the order of court
entered in the above entitled cause on the 15th day

Plaintiffs' Exhibit No. 266

of November, 1913, files the following statement, showing an approximate estimate for the month of October, 1916.

1. Of the amount of ore treated in
its oil flotation plant.....53541.866 Tons
2. Of the amount of concentrates
recovered in its oil flotation plant..14191.495 Tons
3. Of the analysis and assay returns
of heads in its flotation
plant 15.1280% Zn.
1.1496% Pb.
.1969% Cu.
2.3807% Fe.
1.7144% Mn.
66.7682% Insol.
6.0501 Oz. Ag.
.0062 Oz. Au.
4. Of the analysis and assay returns
of concentrates recovered in its
oil flotation 53.414% Zn.
3.830% Pb.
.545% Cu.
2.587% Fe.
.280% Mn.
8.731% Insol.
21.595 Oz. Ag.
.033 Oz. Au.
5. Of the cost of flotation per ton
of concentrates recovered in
its oil flotation plant.....\$ 2.8268

Plaintiffs' Exhibit No. 266

6. Of the value per ton of concentrates recovered in its oil flotation plant\$ 56.89

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates
- | | |
|--|----------------|
| | 1.3140% Zn. |
| | .0800% Pb. |
| | .0400% Cu. |
| | .6000% Fe. |
| | 1.8500% Mn. |
| | 90.2400% Insol |
| | .7800 Oz. Ag. |
| | .0013 Oz. Au. |

Plaintiffs' Exhibit No. 266

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this form the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of November, 1916.

ALF C. KREMER,

Notary Public for the State of Mon-
tana, residing at Butte, Montana.

My commission expires October 2nd,
1919.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 267.

IN THE DISTRICT COURT OF THE UNITED STATES, FOR THE DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, Formerly BUTTE & SUPERIOR COPPER COMPANY, LIMITED,

Defendant.

No. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MINING COMPANY (FORMERLY BUTTE AND SUPERIOR COPPER COMPANY, LIMITED) FOR THE MONTH OF NOVEMBER, 1916, FILED PURSUANT TO ORDER OF COURT ENTERED IN THE ABOVE ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company formerly Butte and Superior Copper Company, Limited) and in compliance with the order of Court entered in the above entitled cause on the 15th day of Novem-

Plaintiffs' Exhibit No. 267

Of the value per ton of concentrates recovered in its oil flotation plant\$ 55.3200

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates

- .941% Zn.
- .050% Pb.
- .020% Cu.
- .660% Fe.
- 1.850% Mn.
- 91.030% Insol.
- .720 Oz. Ag.
- .001254 Oz. Au.

Plaintiffs' Exhibit No. 267

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath
deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of January, 1917.

C. K. TUOHY,

Notary Public for the State of Mont-
tana, residing at Butte, Montana.
My commission expires July 7th,
1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 268.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR MIN-
ING COMPANY, Formerly
BUTTE & SUPERIOR
COPPER COMPANY, LIM-
ITED,

Defendant.

No. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY (FORMERLY BUTTE AND
SUPERIOR COPPER COMPANY, LIMITED)
FOR THE MONTH OF DECEMBER, 1916,
FILED PURSUANT TO ORDER OF COURT
ENTERED IN THE ABOVE ENTITLED
CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company
(formerly Butte and Superior Copper Company, Lim-
ited) and in compliance with the order of Court entered
in the above entitled cause on the 15th day of Novem-

Plaintiffs' Exhibit No. 268

ber, 1913, files the following statement, showing an approximate estimate for the month of December, 1916.

1. Of the amount of ore treated in
its oil flotation plant.....52886.3455 Tons
2. Of the amount of concentrates
recovered in its oil flotation
plant11234.729 Tons
3. Of the analysis and assay re-
turns of heads in its flota-
tion plant12.1680% Zn.
.7428% Pb.
.1630% Cu.
1.7395% Fe.
1.4729% Mn.
71.0963% Insol.
5.2329 Oz. Ag.
.0079 Oz. Au.
4. Of the analysis and assay re-
turns of concentrates recov-
ered in its oil flotation.....52.779% Zn.
3.241% Pb.
.515% Cu.
2.291% Fe.
.280% Mn.
11.065% Insol.
21.093 Oz. Ag.
.027 Oz. Au.

Plaintiffs' Exhibit No. 268

- 5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant\$ 4.3060
- 6. Of the value per ton of concentrates recovered in its oil flotation plant\$ 57.01

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

- 7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates
 - 1.124% Zn.
 - .070% Pb.
 - .030% Cu.
 - .760% Fe.
 - 1.700% Mn.
 - 90.180% Insol.
 - .880 Oz. Ag.
 - .008 Oz. Au.

Plaintiffs' Exhibit No. 268

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of January, 1917.

C. K. TUOHY,

Notary Public for the State of Mon-
tana, residing at Butte, Montana.
My commission expires July 7th,
1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 269.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR MIN-
ING COMPANY, Formerly
BUTTE & SUPERIOR
COPPER COMPANY, LIM-
ITED,

Defendant.

IN EQUITY.

No. 8

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY (FORMERLY BUTTE AND
SUPERIOR COPPER COMPANY, LIMITED)
FOR THE MONTH OF JANUARY, 1917,
FILED PURSUANT TO ORDER OF COURT
ENTERED IN THE ABOVE ENTITLED
CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company
and in compliance with the order of Court entered

Plaintiffs' Exhibit No. 269

in the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of January, 1917.

1. Of the amount of ore treated
in its oil flotation plant46048.870 Tons
2. Of the amount of concentrates
recovered in its oil flotation
plant10100.4635 Tons
3. Of the analysis and assay re-
turns of heads in its flotation
plant12.9230% Zn.
1.0180% Pb.
.1780% Cu.
1.9858% Fe.
1.4932% Mn.
71.8252% Insol.
5.6810 Oz. Ag.
.00855 Oz. Au.
4. Of the analysis and assay re-
turns of concentrates recov-
ered in its oil flotation.....48.820% Zn.
3.904% Pb.
.477% Cu.
2.623% Fe.
.343% Mn.
14.200% Insol.
19.092 Oz. Ag.
.032 Oz. Au.

Plaintiffs' Exhibit No. 269

- 5. Of the cost of flotation per ton of concentrates recovered in its oil flotation\$ 6.2790
- 6. Of the value per ton of concentrates recovered in its oil flotation plant\$ 54.5000

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates, for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

- 7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates
 - 2.6120% Zn.
 - .0600% Pb.
 - .0400% Cu.
 - .6400% Fe.
 - 1.6000% Mn.
 - 88.4000% Insol.
 - 1.1200 Oz. Ag.
 - .0013 Oz. Au.

Plaintiffs' Exhibit No. 269

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of February, 1917.

C. K. TUOHY,

Notary Public for the State of Mon-
tana, residing at Butte, Montana.
My commission expires July 7th,
1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 270.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff,

vs.

BUTTE & SUPERIOR MIN-
ING COMPANY, Formerly
BUTTE & SUPERIOR
COPPER COMPANY, LIM-
ITED,

Defendant.

No. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY (FORMERLY BUTTE AND
SUPERIOR COPPER COMPANY, LIMITED)
FOR THE MONTH OF FEBRUARY, 1917,
FILED PURSUANT TO ORDER OF COURT
ENTERED IN THE ABOVE ENTITLED
CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company
and in compliance with the order of Court entered

Plaintiffs' Exhibit No. 270

in the above entitled cause on the 15th day of November, 1913, files the following statement, showing an approximate estimate for the month of February, 1917

1. Of the amount of ore treated
in its oil flotation plant.....43216.8605 Tons
2. Of the amount of concentrates
recovered in its oil flotation
plant9980.6145 Tons
3. Of the analysis and assay re-
turns of heads in its oil flo-
tation plant12.9875% Zn.
.9091% Pb.
.1699% Cu.
1.9109% Fe.
1.2430% Mn.
71.6749% Insol.
5.2422 Oz. Ag.
.0097 Oz. Au.
4. Of the analysis and assay re-
turns of concentrates recov-
ered in its oil flotation.....45.6390% Zn.
3.6760% Pb.
.5060% Cu.
2.7280% Fe.
.5680% Mn.
19.1930% Insol.
17.4720 Oz. Ag.
.0275 Oz. Au.

Plaintiffs' Exhibit No. 270

- 5. Of the cost of flotation per ton of concentrates recovered in its oil flotation plant.....\$ 5.5544
- 6. Of the value per ton of concentrates recovered in its oil flotation plant\$ 50.084

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

- 7. As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates
- 1.9560% Zn
- .0800% Pb.
- .0380% Cu.
- .6200% Fe.
- 1.5000% Mn.
- 90.0000% Insol.
- .8500 Oz. Ag.
- .0018 Oz. Au.

Plaintiffs' Exhibit No. 270

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Cashier of the Butte and Superior Mining Company, and makes this affidavit for and on its behalf; that he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of March, 1917.

C. K. TUOHY,

Notary Public for the State of Montana,
residing at Butte, Montana.
My commission expires July 7th,
1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 271.

IN THE DISTRICT COURT OF THE UNITED
STATES, FOR THE DISTRICT OF
MONTANA.

MINERALS SEPARATION,
LIMITED,

Plaintiff

vs.

BUTTE & SUPERIOR MIN-
ING COMPANY, Formerly
BUTTE & SUPERIOR
COPPER COMPANY, LIM-
ITED,

Defendant.

No. 8
IN EQUITY.

STATEMENT OF BUTTE AND SUPERIOR MIN-
ING COMPANY FOR THE MONTH OF
MARCH, 1917, FILED PURSUANT TO OR-
DER OF COURT ENTERED IN THE ABOVE
ENTITLED CAUSE ON NOVEMBER 15th, 1913.

Comes now Butte and Superior Mining Company
formerly Butte and Superior Copper Company, Lim-
ited) and in compliance with the order of Court entered
in the above entitled cause on the 15th day of Novem-

Plaintiffs' Exhibit No. 271

ber, 1913, files the following statement, showing an approximate estimate for the month of March, 1917

1. Of the amount of ore treated in its oil flotation plant.....47202.599 Tons
2. Of the amount of concentrates recovered in its oil flotation plant10642.6505 Tons
3. Of the analysis and assay returns of heads in its oil flotation plant

12.4893% Zn.
.8578% Pb.
.1598% Cu.
1.8901% Fe.
1.4681% Mn.
73.0481% Insol.
4.8032 Oz. Ag.
.00584 Oz. Au.
4. Of the analysis and assay returns of concentrates recovered in its oil flotation.....

47.207% Zn.
3.700% Pb.
.489% Cu.
3.000% Fe.
.400% Mn.
16.500% Insol.
18.240 Oz. Ag.
.0267 Oz. Au.

Plaintiffs' Exhibit No. 271

Of the cost of flotation per ton of concentrates recovered in its ^{oil} flotation plant..\$ 6.0242

Of the value per ton of concentrates recovered in its oil flotation plant.....\$43.81

The figures set forth under the foregoing six paragraphs are, as noted, approximate estimates; for the reason that at the date of the filing of this statement no exact information has been acquired by the Butte and Superior Mining Company, so that accurate figures can be given.

As to the analysis and assay returns of tails from the oil flotation plant, the following figures are accurate, and not estimates

1.997% Zn.
.115% Pb.
.040% Cu.
.800% Fe.
1.650% Mn.
89.600% Insol.
.840 Oz. Ag.
.0012. Oz. Au.

Plaintiffs' Exhibit No. 271

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,—ss:

CHAS. BOCKING, being first duly sworn on oath,
deposes and says:

That he is the Assistant Manager of the Butte and Superior Mining Company, and makes this affidavit for and on behalf of said company: That the Butte and Superior Mining Company is the defendant in the foregoing action; That he has read the foregoing statement and knows the contents thereof; that the approximate estimates therein set forth are true to the best of his knowledge, information and belief; that such approximate estimates in said report are set forth under paragraphs 1 to 6, inclusive; that as to the analysis and assay returns of this from the oil flotation plant under paragraph 7 of said statement, the same is not an approximate estimate, but that the percentages and weights contained in the answer thereto are accurate, to the best of his knowledge, information and belief.

CHAS. BOCKING.

Subscribed and sworn to before me
this 20th day of April, 1917.

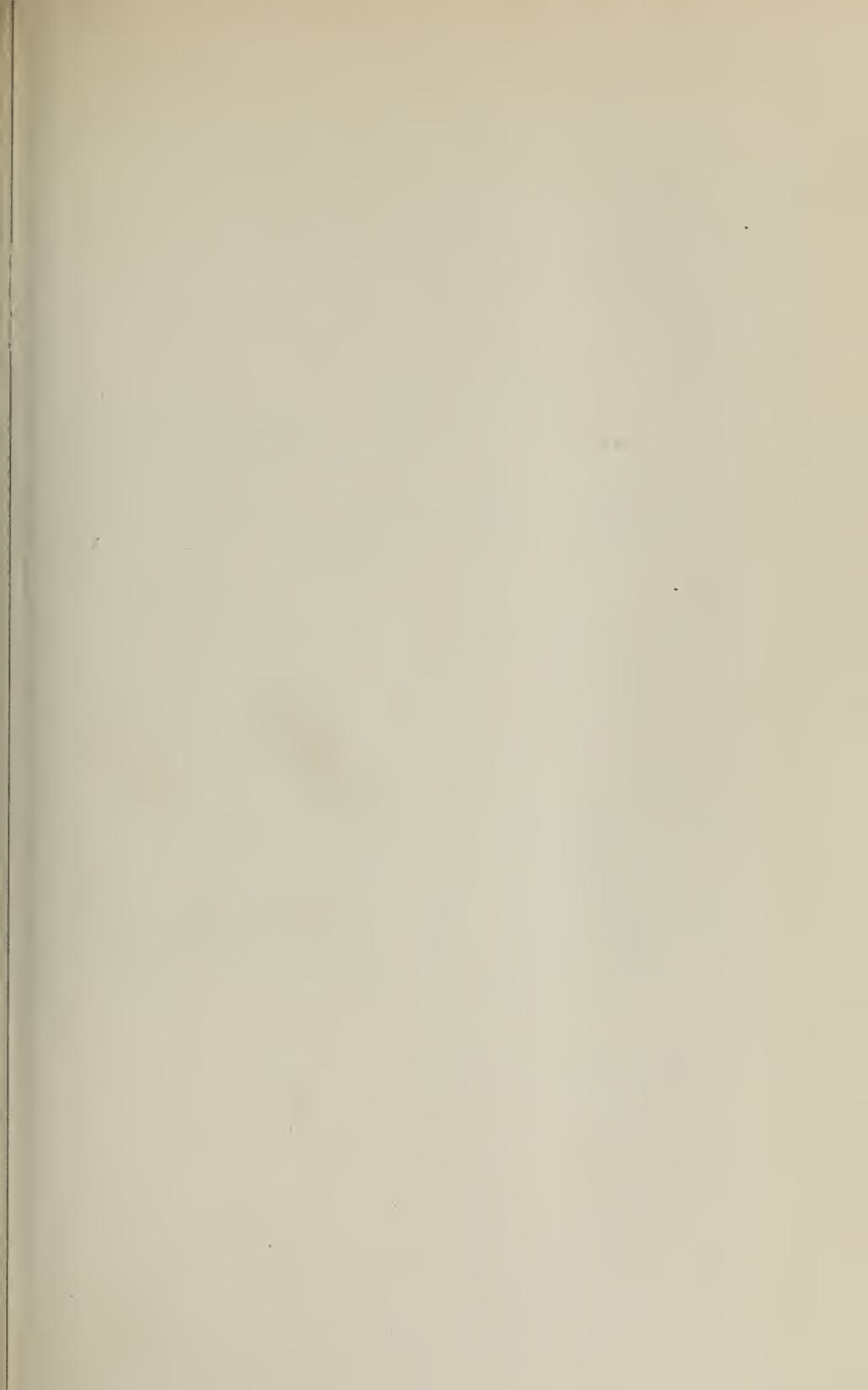
C. K. TUOHY,

Notary Public for the State of Mon-
tana, residing at Butte, Montana.

My commission expires July 7th,
1918.

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Plai

MINERALS SEPARATION, LIMITED

BUTTE & SUPERIOR

Calculated from the Sworn State

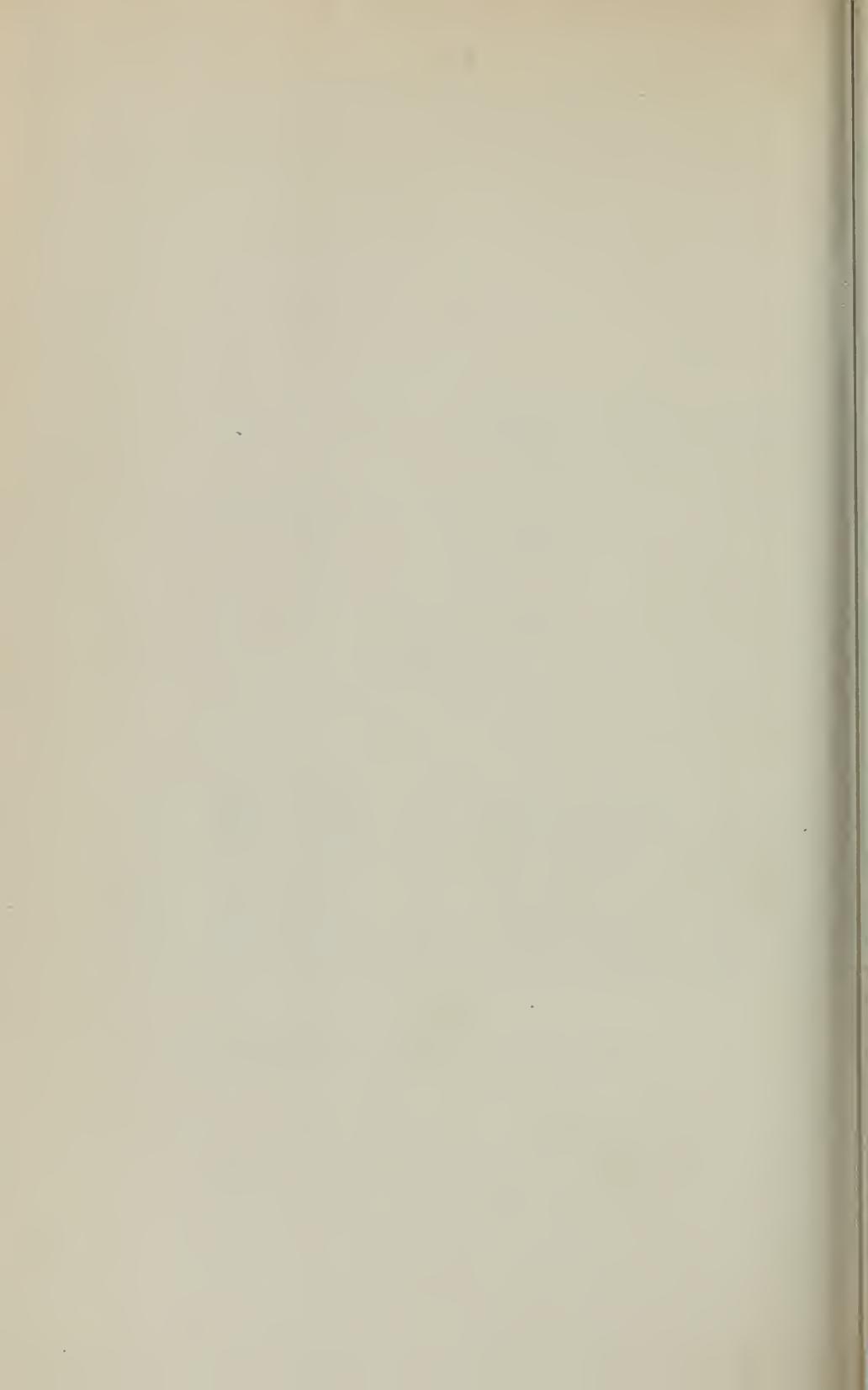
PERIOD	ORE DELIVERED TO PLANT			Ratio of Concentration	CONCENT	
	Tons	Assay % Zinc	Zinc Content Tons		Tons	Assay % Zinc
1916—October	53,542	15.128	8099.83	3.77	14191	53.414
November	50,495	13.001	6564.25	4.43	11398	53.524
December	52,886	12.168	6435.17	4.71	11235	52.779
1916—Last Quarter.....	156,923	13.446	21099.85	4.26	36824	53.254
1917—January	46,049	12.923	5950.91	4.56	10100	48.820
February	43,217	12.988	5613.02	4.33	9981	45.639
March	47,203	12.489	5895.18	4.44	10643	47.207
1917—First Quarter.....	136,469	12.793	17459.11	4.44	30724	47.228

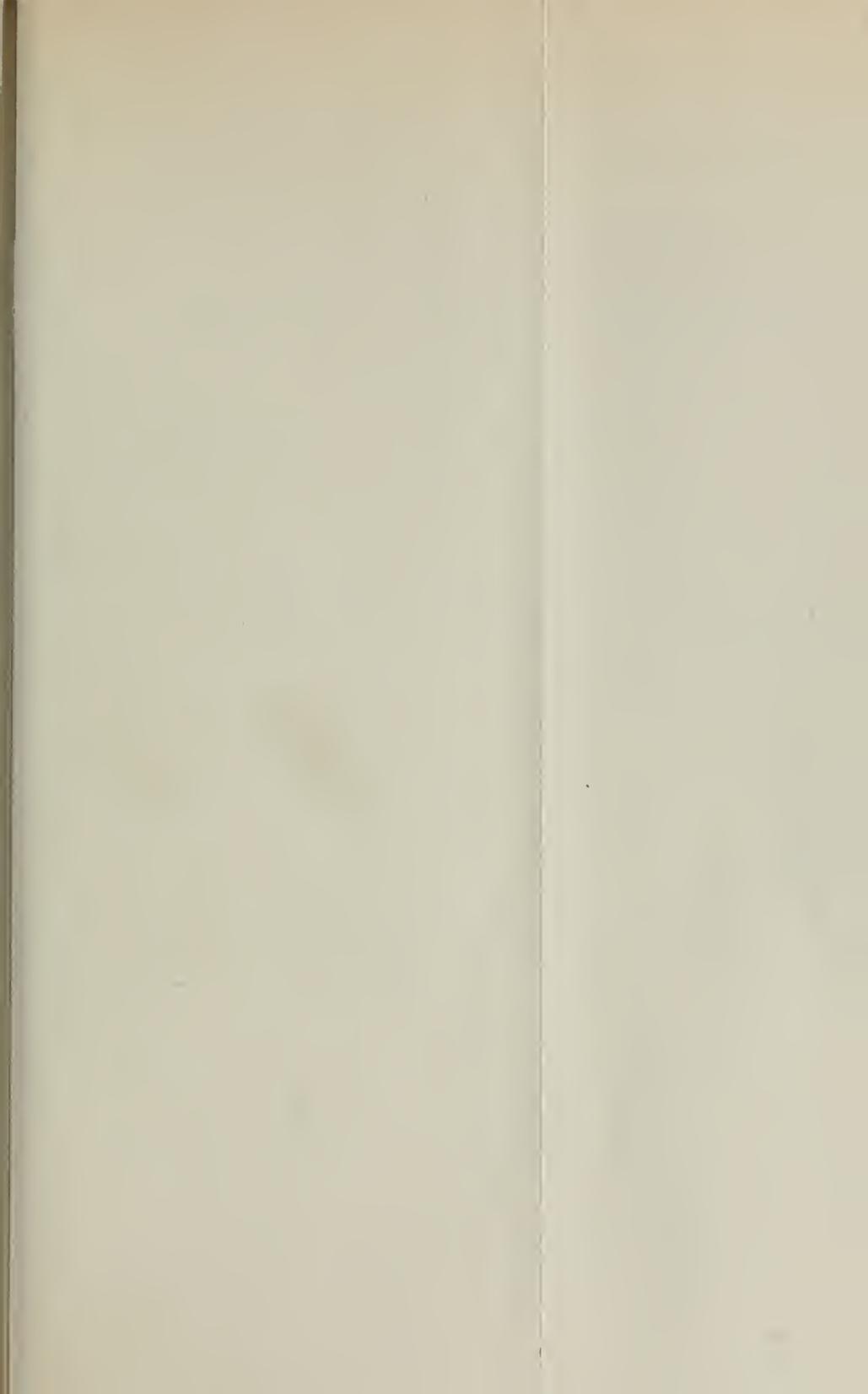
b. 272.

WYATT & SUPERIOR MINING COMPANY
 FLOTATION PLANT RESULTS
 Submitted to the Federal Court, Butte, Mont.

TAILINGS					Oils	Other Reagents	COSTS -- \$		
Tons (By Difference)	Zinc Contents Tons (By Difference)	Lbs. Zinc Per Ton of Heads	Assay % Zinc Calculated	Assay % Zinc Given			Total	Per Ton Ore	Per Ton Concentrate
9,351	519.85	19.41	1.321	1.314		40,115	0.7492	2.8268	
9,097	464.18	18.39	1.187	0.941		40,821	0.8084	3.5814	
1,651	505.45	19.12	1.214	1.124		48,378	0.9148	4.3060	
0,099	1489.48	19.11	1.240	1.127		129,314	0.8241	3.5117	
9,949	1020.09	44.30	2.838	2.612		63,418	1.3772	6.2790	
3,236	1057.79	48.95	3.183	1.956		55,438	1.2828	5.5544	
6,560	870.94	36.90	2.382	1.997		64,116	1.3583	6.0242	
5,745	2948.82	43.22	2.789	2.192		182,972	1.3408	5.9553	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.





MINERALS SEPARATION, LIMITED, ET AL

FLOTATION

Calculated from the Sworn Statements of the Managers

Comparisons made between the results of operation with excess oil with the headings to flotation were of as nearly equal Zinc assay as possible. Only the has been calculated in all cases on the same terms and market price for spelter

PERIOD.	Heading to Flotation			Concentrates			% Zn. Recovery (By Contents)	Tons By difference
	Tons	Assay % Zn.	Zinc Contents Tons	Tons	Assay % Zn.	Zinc Contents Tons		
1916—January	49428	12.496	6176.52	10535	54.593	5751.37	93.117	38893
1917—March	47203	12.489	5895.18	10643	47.207	5024.24	85.228	36560
Differences.....		.007			7.386		7.889	
1916—June	48475	12.976	6290.12	10830	54.579	5910.91	93.972	37645
1917—February	43217	12.988	5613.02	9981	45.639	4555.23	81.155	33236
Differences.....		.012			8.940		12.817	
1916—November	50495	13.001	6564.85	11398	53.524	6100.67	92.929	39097
1917—January	46049	12.923	5950.91	10100	48.820	4930.82	82.858	33236
Differences.....		.078			4.704		10.071	

The figures indicate that the modification of the operating with excess oil to the flotation plant, and that it would be necessary to provide some more equipment for low oil. The silver loss is also somewhat greater. With the market price of spelter

FORMULA ADOPTED FOR PURPOSE OF COMPARISON.

APPENDIX "A"—

Conditions of Sale of Zinc Concentrates Taken for the Sake of Making Comparison of the Financial Results of the Period of Working with Excess Oil with Those of 1916:

Assume Market Quotation for Spelter at East St. Louis.....	\$9.50 per 100
(Being below the average for the period in question.)	
For One Ton of Concentrate of 45% Zinc.....	\$21
(Being the usual contract price.)	
For each one dollar of the market quotation above five dollars (\$5.00)	
add six dollars (\$6.00) per ton of concentrate.	
For each unit of zinc in the concentrate above forty-five per cent (45%)	
add ninety cents (90c) per ton of concentrate.	
Allowance for freight, loading, and moisture, per dry ton of concentrate.....	\$8

273.

ND SUPERIOR MINING COMPANY

LTS.

Superior Company to the Federal Court in Butte.

small quantities. For this purpose periods have been chosen in which has been taken into account. The sales value of the Zinc Concentrates Figures for oil and acid taken from Defendant's Exhibit No. 158.

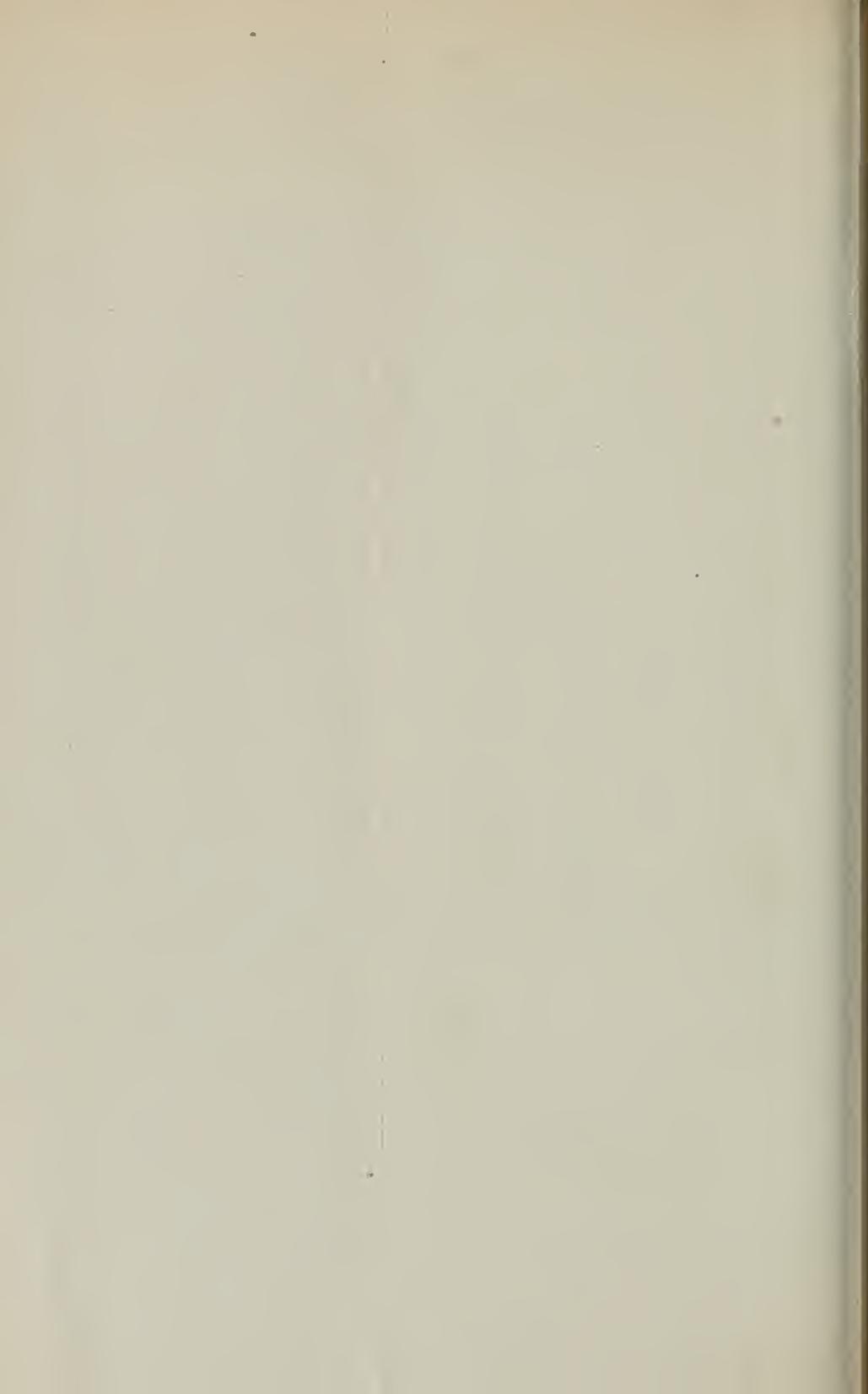
% Zinc.	Oils		Costs			Sales value of concentrates on equal terms as shown on Appendix A (Zinc only)			Profit	
	Given	Per Ton of Heading	Per Ton of Heading	Per ton of Heading	Per ton of Concentrates	Total Cost.	Per ton of Heading	Per ton of Concentrates	Total	Per ton of Heading	Per ton of Concentrates
1.2008	about 1.7	about 5.00	\$ 0.652	\$ 3.0583	\$ 32219	\$ 10.36	\$ 48.63	\$ 512317	\$ 9.71	\$ 45.57
1.997	about 22.0	about 10.00	1.3583	6.9242	64116	9.47	41.99	446900	8.11	35.97
			0.706	2.9659	31897	.89	6.64	65417	1.60	9.64
1.0766	about 1.7	about 5.00	0.7170	3.2105	34770	10.86	48.62	526555	10.14	45.41
1.956	about 20.2	about 10.00	1.2828	5.5544	55438	9.37	40.58	405029	8.09	35.03
			0.5658	2.3439	20668	1.49	8.04	121526	2.05	10.38
0.941	about 1.5	about 5.0	0.8084	3.5814	40821	10.76	47.67	543343	9.96	44.09
2.612	about 20.0	about 10.0	1.3772	6.2790	63418	9.53	43.44	438744	8.15	37.16
			0.5688	2.6976	22597	1.23	4.23	104599	1.81	6.93

ease of profit from the Zinc alone of about \$1.75 per ton of ore delivered capacity of the plant to what it was with the old operating method with the decrease of profit on one year's tonnage of 580000 would be \$1,015,000.

P.E.—January 1916.

VALUE OF ONE DRY TON OF CONCENTRATE.

for 45% grade.....	\$21.00
increase of grades: Grade	54.59
Basis	45.00
Increase	9.59 @ \$0.90 8.63
increase in market price: Market price.....	9.50
Basis	5.00
	4.50 @ \$6 27.00
	56.63
it, loading and moisture.....	8.00
	\$48.63



Plaintiffs' Exhibit No. 274.

Estimate of increased revenue to Butte & Superior Copper Co. had it followed wet concentration with flotation during period of milling operations at Basin, Montana, January 1st, 1910, to April 30, 1912:

1910

Dry tons milled at Basin.....	94,085	Assay value 20.2% Zn
Conc. produced—tons	22,157	Assay value 47.7% Zn

1911

Dry tons milled at Basin.....	148,542	Assay value 20.3% Zn
Conc. produced—tons	34,464	Assay value 49.1% Zn

1912

Jan. to April, inclusive,		Estimated
estimated tons milled.....	50,000	Assay value 20.0% Zn
Estimated production, 57% recovery,		
49% grade concentrate.....	11,630	tons conc.

Total tons treated at Basin

Jan. 1st, 1910, to Apr. 30, 1912.....	292,627 tons
Zinc content	59,159 tons
Total tons zinc conc. made at Basin.....	68,251 tons
Zinc content	33,189 tons
Total recovery at Basin in form of zinc conc.....	56.1%

Net Smelter Returns

1910—Net value per ton conc.....	\$19.67	\$ 496,099.49
1911—Net value per ton conc.....	\$24.85	875,369.73
1912—Estimated ditto	\$26.00	302,380.00

\$1,673,849.22

Operating costs—same period

1910—Mining & Dev.....	\$3.15 per ton	\$296,367.75	
Ore Transp. ....	.55 per ton	51,746.75	
Milling	1.75 per ton	164,648.75	
1911—Mining & Dev.....	\$3.06 per ton	454,538.52	
Ore Transp. ....	.26 per ton	38,620.92	
Milling	1.62 per ton	240,638.04	
1912—Estimated:			
Mining & Dev.....	\$3.06 per ton	153,000.00	
Ore Transp. ....	.26 per ton	13,000.00	
Milling	1.62 per ton	81,000.00	\$1,493,560.73
Operating profit at Basin.....			\$ 180,288.49

Plaintiffs' Exhibit No. 274

Total ore treated at Basin.....	292,627 tons
Zinc conc. produced.....	68,251 tons
Lead conc. produced.....	752 69,003 tons
<hr/>	
Total tons tailings to discard.....	223,624 tons
Containing	25,780 tons of zinc
Calculated % of zinc in discarded tailings.....	11.34% Zn.

Assume that all discarded tailings were re-ground and treated by flotation at an extra operating cost of 75 cents per ton with results as follows:

Concentrate	55% Zn	24 Oz Ag	.04 Au
Tailings	1.5% Zn		
Recovery		89.25%	

Zinc concentrate produced by flotation from discarded tailings—41,834 tons, containing 23,008.65 tons of zinc.

Value of 41,834 tons zinc concentrate, assumed to have been produced from Basin mill discarded tailings—

55% Zn at average market price.....	5.67 cents
24 Oz. Ag. average market price.....	54 cents
.04 Oz. Au. @ \$19.00 .....	.....equals
Value of zinc.....	\$37.19
Net value Ag. & Au.....	3.88
	<hr/>
	\$41.07
Less freight	\$7.91
Loading at Basin.....	.09
Mesh penalty .....	.50 8.50
	<hr/>
Net value per ton.....	\$32.57
41,834 tons @ \$32.57.....	\$1,332,533.38
Less estimated cost of flotation treatment,	
223,624 tons @ 75c	167,718.00
	<hr/>
Estimated excess operating profit.....	\$1,194,815.38
Deduct for cost of construction of 500 ton	
flotation plant	90,000.00
	<hr/>
Increase in net profit.....	\$1,104,815.38

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 275.

MINERALS SEPARATION LIMITED ET AL VS. BUTTE AND SUPERIOR MINING COMPANY
 Comparison of results at Timber Butte and Butte and Superior Mills for 1st quarter of 1917.

Mill	Material	Tons	Tons per cent of feed	Assay Zinc %	Tons of Zn. products of flotation feed	% of zinc in flotation products by flotation feed and conc.	Recovery of zinc in flotation products by flotation conc. and tailing
Timber Butte Mill	Flotation feed	37992.8	100.000	14.295	14.295	100.00	100.00
	Flotation concentrate	9742.6	25.643	54.474	13.969	97.72	96.34
	Flotation tails (given)	28250.2	74.357	0.714	0.531	3.71	3.64
	Flotation tails (calculated)	28250.2	74.357	0.438	0.326	2.28	.....
Butte & Superior Mill	Flotation feed	136469	100.000	12.793	12.793	100.00	100.00
	Flotation concentrate	30724	22.514	47.228	10.632	83.11	86.23
	Flotation tails (given)	105745	77.486	2.192	1.698	13.27	13.77
	Flotation tails (calculated)	105745	77.486	2.789	2.161	16.89	.....

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
 By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 276.

BOTTLE OF OIL.

(Physical Exhibit)

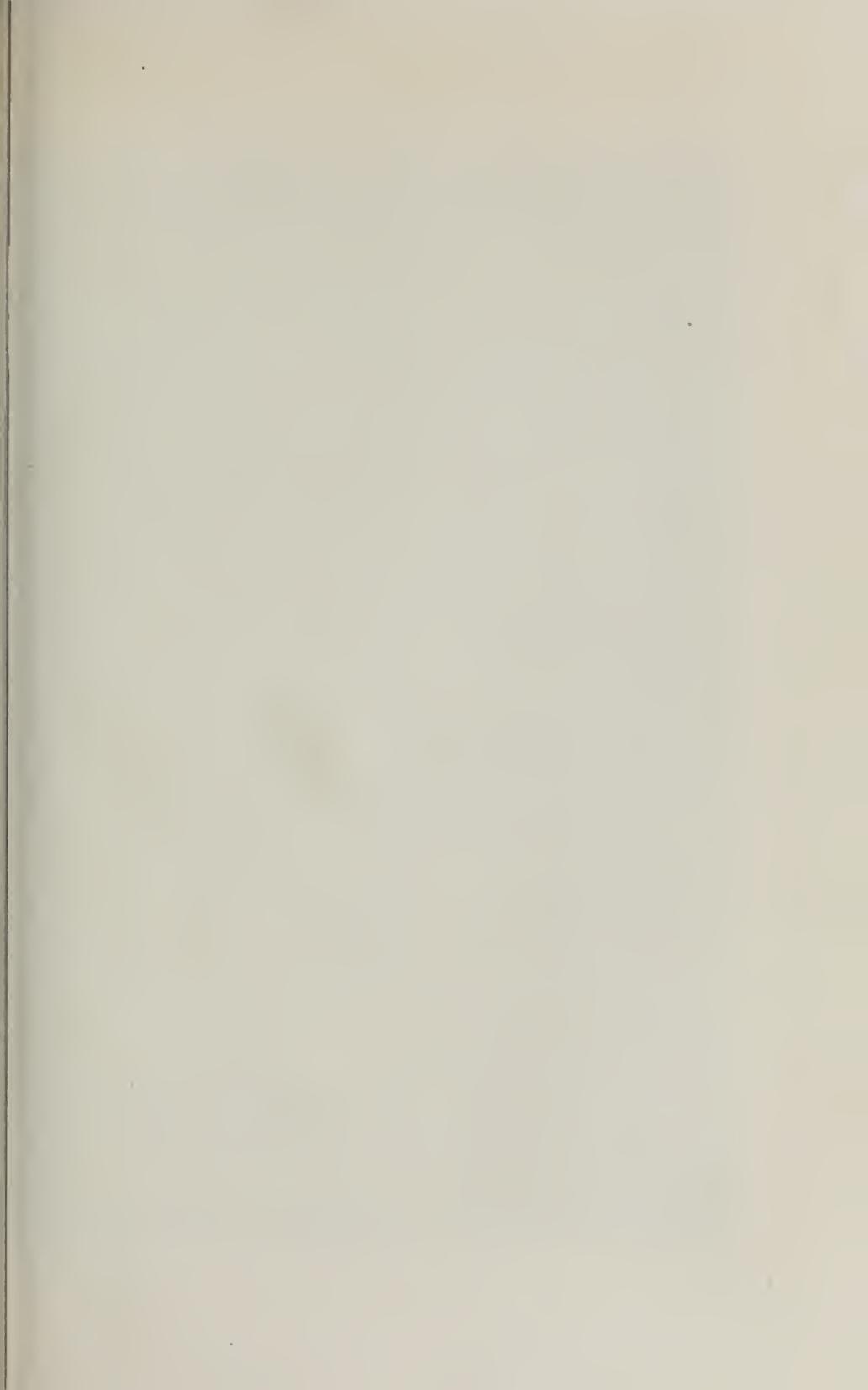
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 277.

3 REELS FILMS.

(Physical Exhibit)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Plaintiffs' Exhibit No. 278.

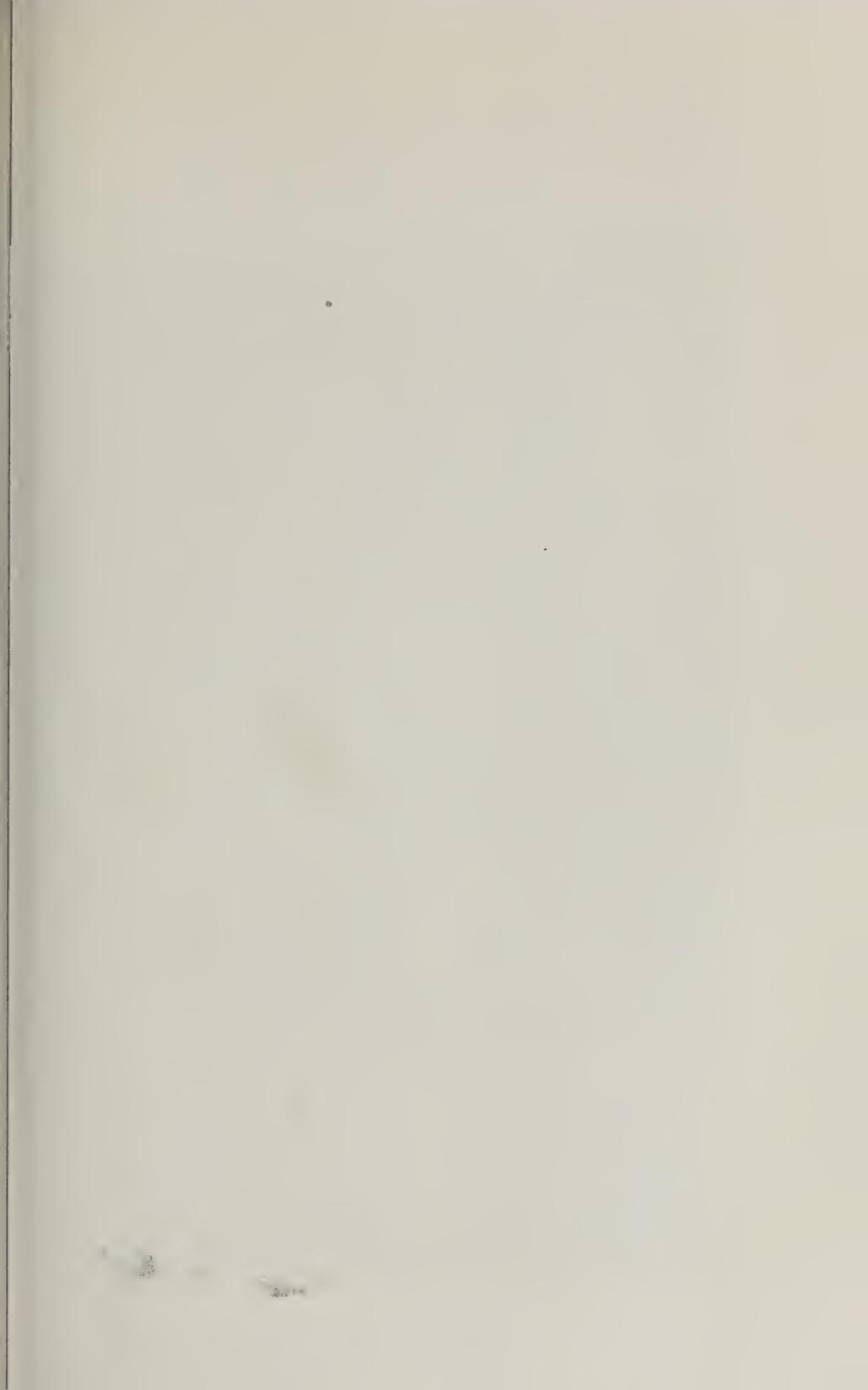
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 279.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.





Plaintiffs' Exhibit No. 280.

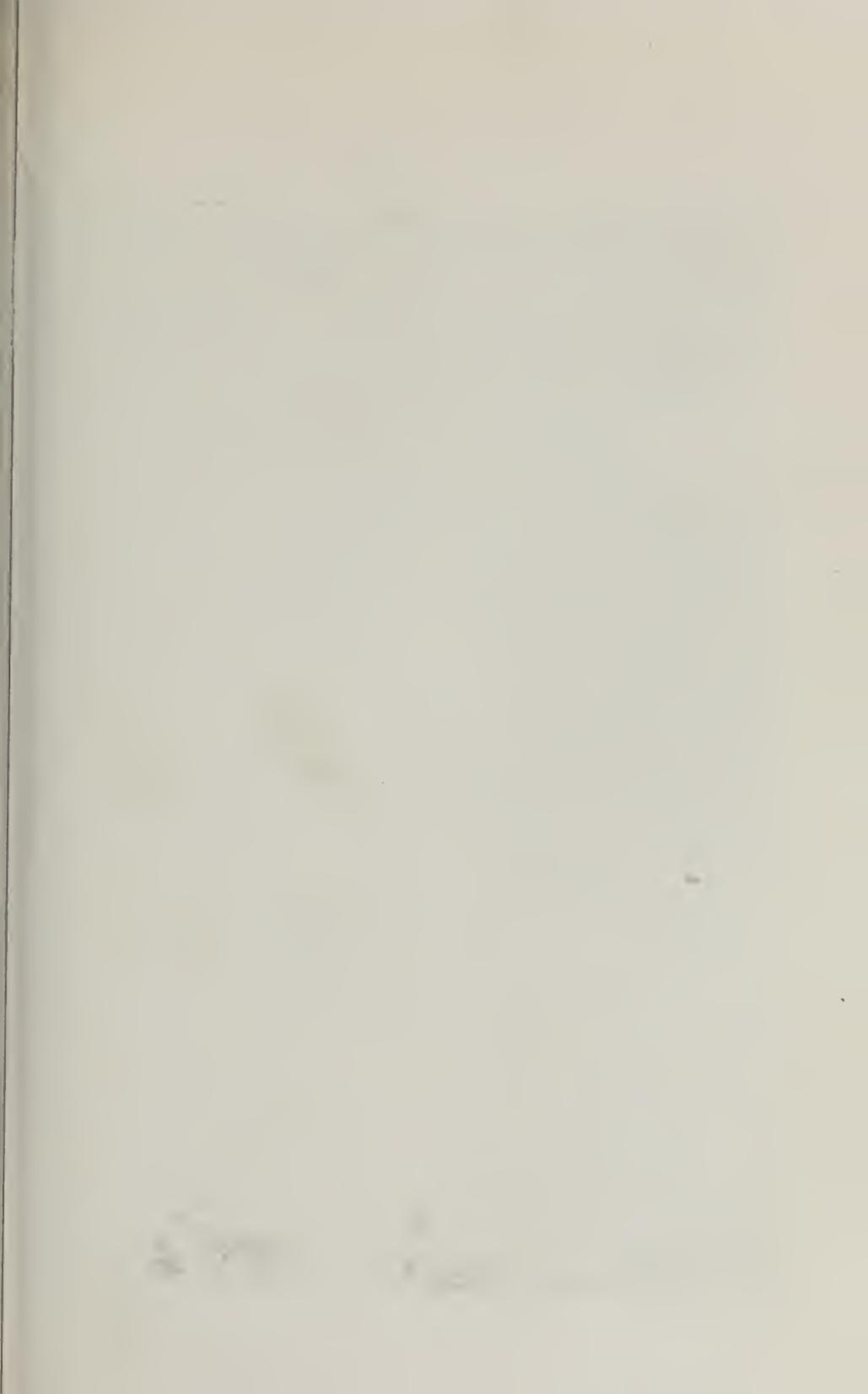


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 281.



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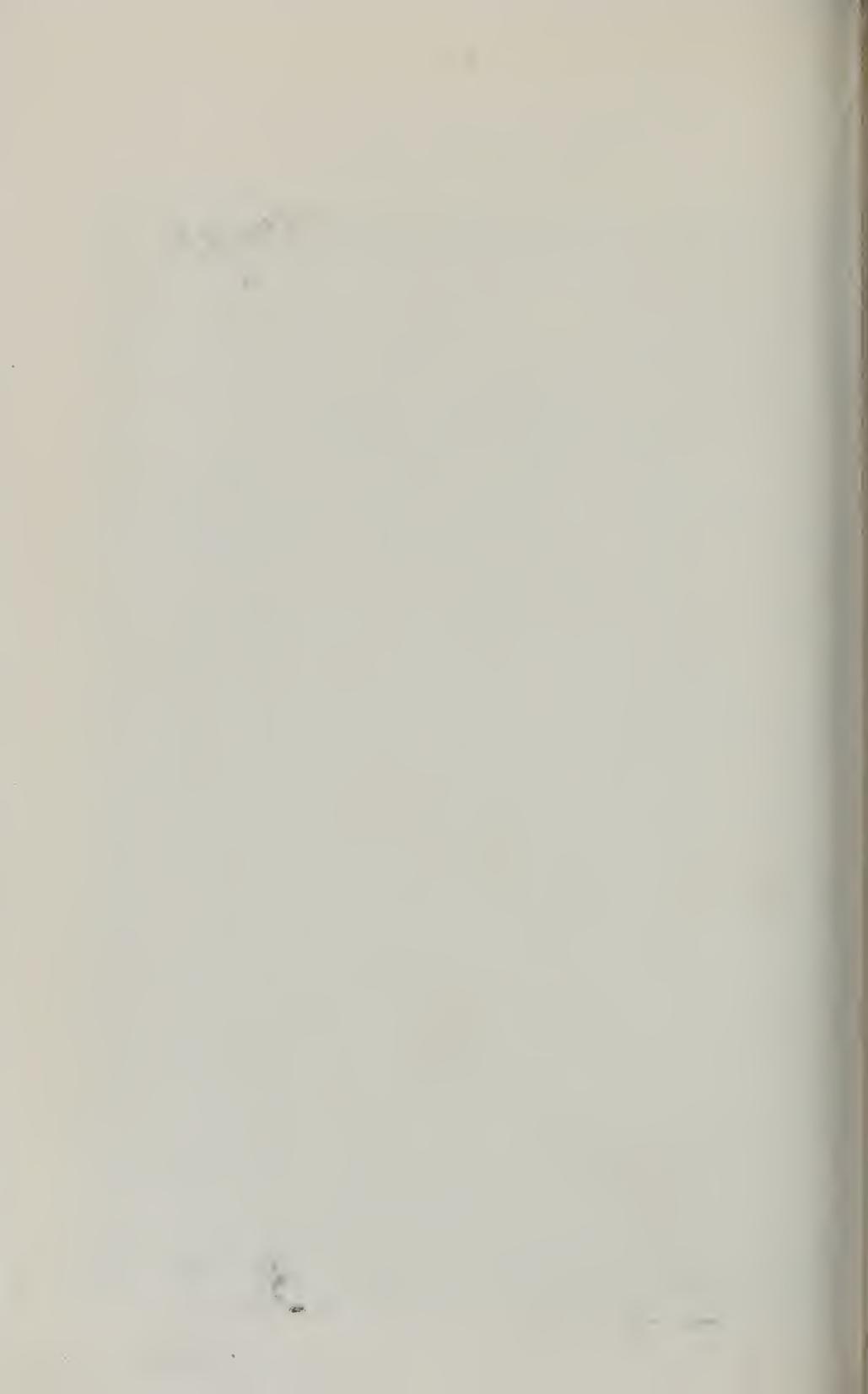
Plaintiffs' Exhibit No. 282.

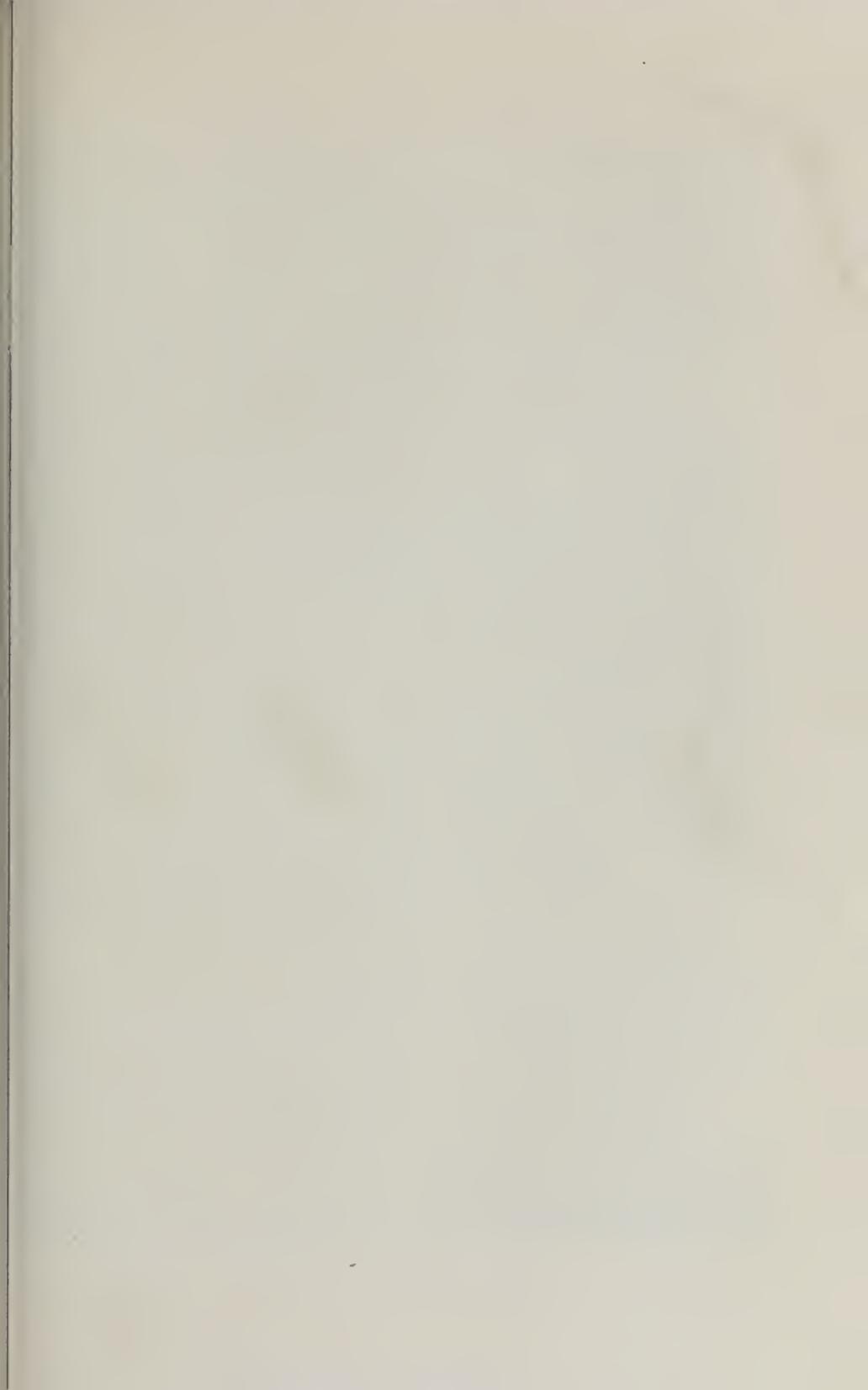


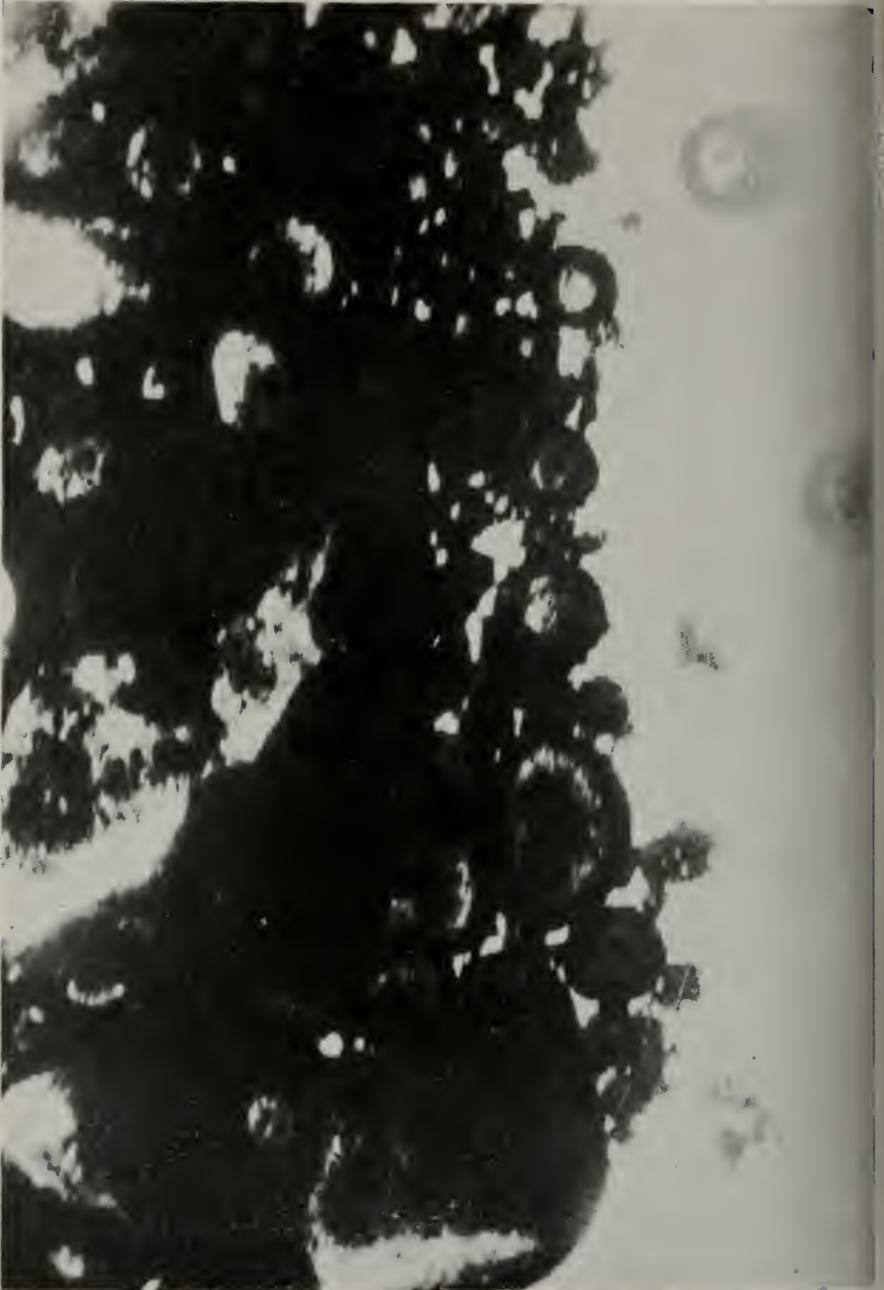
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 283.







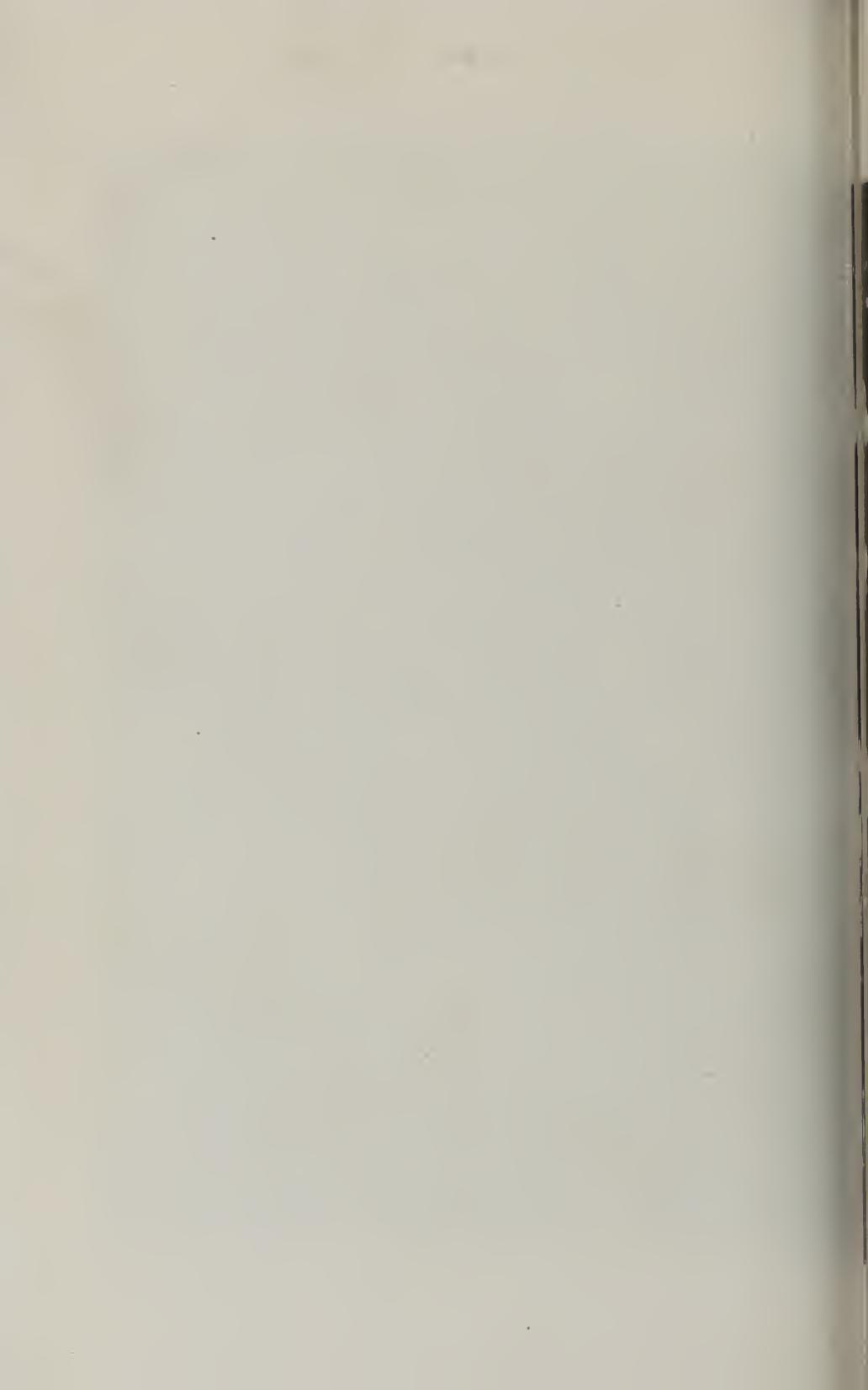
Plaintiffs' Exhibit No. 284.

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

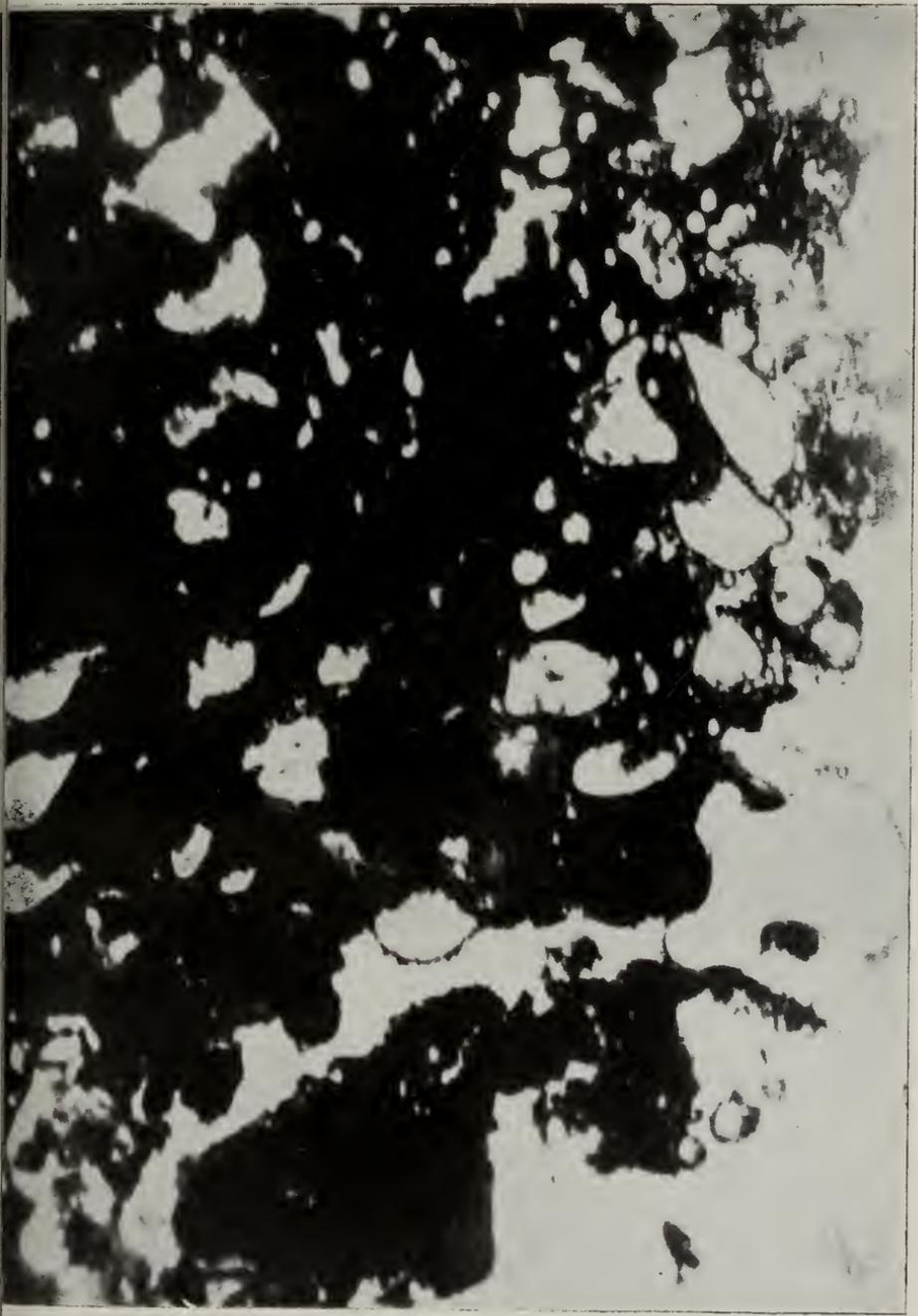
Plaintiffs' Exhibit No. 285.

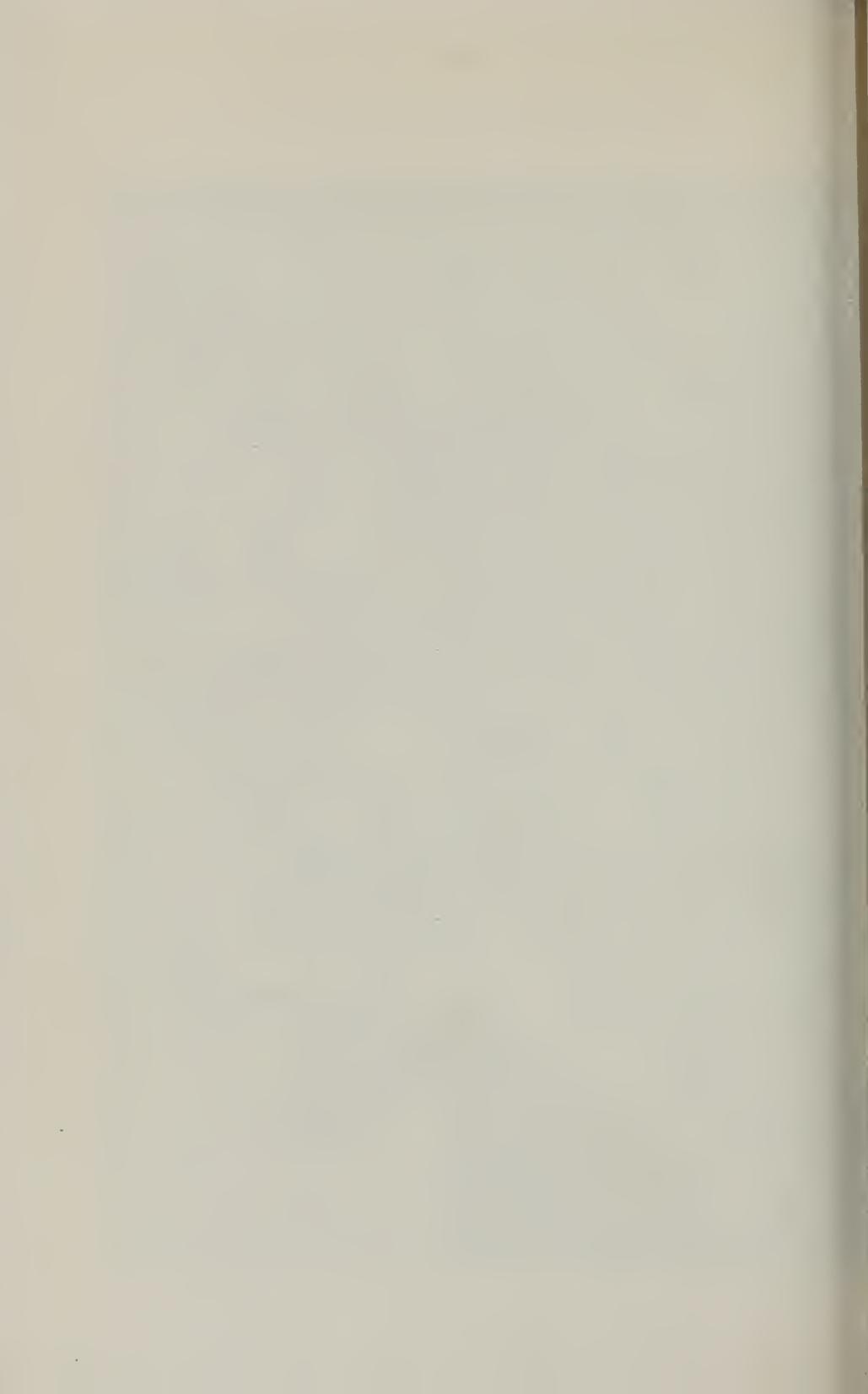


Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

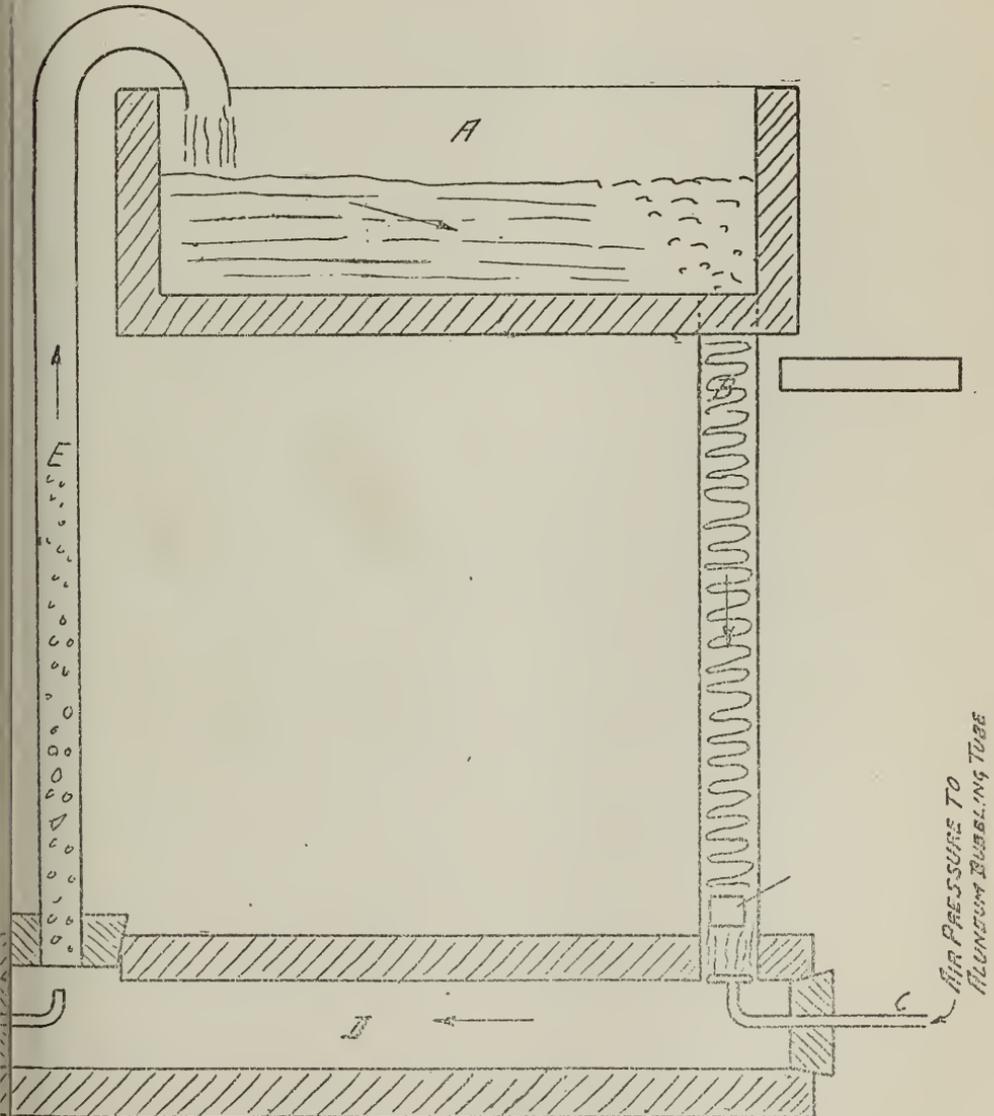


Plaintiffs' Exhibit No. 286.





PLAINTIFF'S EXHIBIT No 287—W. M. G.



Plaintiffs' Exhibit No. 288.

(A)

AGREEMENT OF JULY 8, 1913

Between

MINERALS SEPARATION LIMITED

And

MINERALS SEPARATION AMERICAN SYNDI-
CATE (1913) LIMITED.

129802/33

(Companies' Registration

Registered

Office 29 Mar. 1916)

95416f

Aug 1913

AN AGREEMENT made the eighth day of July One thousand nine hundred and thirteen BETWEEN MINERALS SEPARATION LIMITED having its registered office at 62 London Wall in the City of London (hereinafter called the Company) of the one part and MINERALS SEPARATION AMERICAN SYNDICATE (1913) LIMITED having its registered Office at 62 London Wall aforesaid (hereinafter called the Syndicate) of the other part. WHEREAS the Syndicate was incorporated on the twenty-seventh day of June One thousand nine hundred and thirteen under the Companies (Consolidation) Act 1908 with a nominal capital of Two hundred and fifty thousand pounds divided into One hundred and twenty-five thousand A shares of One

Plaintiffs' Exhibit No. 288

P. 5459, L. 3, After "Whereas" insert "by Clause 2 of the Articles of Association of the Syndicate"

NOW it is hereby agreed as follows:—

1. The Company shall sell and the Syndicate shall purchase.

First—The Letters Patent and rights mentioned in the Schedule hereto but subject to certain Licenses granted by the Company the dates of which and the names of the Licensees mentioned therein are as follows:—

- (A) Twenty fifth June One thousand nine hundred and twelve The Cuba Copper Company.
- (B) Nineteenth November One thousand nine hundred and twelve Britannia Mining and Smelting Company Limited as modified by letter dated Seventeenth December One thousand nine hundred and twelve from the Company to the said Britannia Mining and Smelting Company Limited.
- (C) Sixteenth January One thousand nine hundred and thirteen The Silvertown Mines Limited and Robert Insinger.
- (D) Twenty seventh February One thousand nine hundred and thirteen. The Ducktown Sulphur & Copper and Iron Company Limited.
- (E) Tenth April One thousand nine hundred and thirteen. The Inspiration Consolidated Copper Company.

Plaintiffs' Exhibit No. 288

- (F) Seventh May One thousand nine hundred and thirteen. The Elm Orlu Mining Company.
- (G) Seventh May One thousand nine hundred and thirteen. The Colusa Parrot Mining and Smelting Company.
- (H) Thirteenth May One thousand nine hundred and thirteen William B. McDonald and Louis S. Nobel.

Secondly: The benefit and rights of the Company of and under the said licenses and of any other licenses that may be granted prior to the completion of the purchase and Thirdly: The exclusive right so far as the Company can confer the same to apply for and obtain in the Republic of Cuba and the Phillipine Islands Patents in connection with any of the Inventions comprised in the Letters Patent and applications mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating different pulverulent materials by oil selection gas^{eous} flotation or other surface Tension phenomena.

2. Part of the consideration for the said sale shall be the sum of Ninety three thousand seven hundred and fifty pounds which shall be paid and satisfied by the allotment to the Company or its nominee or nominees of One hundred and eighty seven thousand five hundred fully paid B shares of Ten shillings each in the Capital of the Syndicate.

3. As the residue of the consideration for the said sale the Syndicate shall indemnify the Company against all liability and obligations of the Company

P. 5461, L. 21, After "Company" insert "All disbursements already made by the Company"

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Plaintiffs' Exhibit No. 288

nder or in respect of any of the licenses granted by them and particulars of which are set out in Clause hereof and shall also indemnify the Company against all liability and obligations of the Company under or in respect of all costs and charges already or hereafter to be incurred by the Company in connection with applying for and taking out patents in the said Republic of Cuba and the Syndicate shall further indemnify the Company against the liabilities of the Company under a letter dated second day of March One thousand nine hundred and ten from the Company to One James M. Hyde and against all sums which the Company may have been ordered and may be ordered to pay to the said James M. Hyde in connection with certain litigation pending between the Company and the said James M. Hyde in the United States of America and against the costs, charges and expenses of the Company in connection with the said litigation and the Syndicate shall at once repay to the Company on account thereof or in connection therewith. The Syndicate shall be entitled to receive all damages and any other profits or benefits which may be derived from or in connection with the said litigation.

The purchase shall be completed on or before the tenth day of October One thousand nine hundred and thirteen at the registered office of the Syndicate when One hundred and thirty seven thousand five hundred fully paid B shares of Ten shillings each in the Capital of the Syndicate part of the said One hundred and

Plaintiffs' Exhibit No. 288

eighty, seven thousand five hundred fully paid B shares shall be allotted to the Company or its nominees and the Company and all other necessary parties if any shall at the expense of the Syndicate, execute and do all assurances and things for vesting in the Syndicate, the full benefit of this Agreement as shall be reasonably required. As to fifty thousand fully paid B shares of Ten shillings each in the Capital of the Syndicate the balance of the said One hundred and eighty seven thousand five hundred B shares the same shall be allotted to the Company or its nominees at the rate of Two shares for every one "A" share of One pound each in the initial capital of the Syndicate part of the last Twenty five thousand A shares in such capital which shall be hereafter allotted that is to say when one of such "A" shares shall be allotted there shall be allotted to the Company or its nominees Two of such fully paid "B" shares. No new shares in the Capital of the Syndicate shall be created or issued until the whole of the shares in the initial capital of the Syndicate shall have been allotted.

5. The Company shall with all convenient speed and at cost price communicate to the Syndicate or its assigns all improvements, additions and new discoveries which it shall make or acquire or be interested in either alone or jointly with others in connection with any of the inventions comprised in the Letters Patent mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating pulverulent materials by oil selection, gaseous flotation

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P. 5462, L. 7, After "dicate" insert "or as it shall direct the premises mentioned in the Schedule hereto and giving to the Syndicate"

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or its as-
discoveries
rested in
ction with
rs Patent
ly in con-
eparating
flotation

Plaintiffs' Exhibit No. 288

or other surface tension phenomena and shall give to the Syndicate or its assigns as full information as may be possible as to the exact mode of working and using such improvements, additions and new discoveries but any plans, drawings and models required by the Syndicate or its assigns in connection therewith shall be furnished to the Syndicate or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Syndicate or its assigns execute and do all such documents and things as may be requisite for enabling the Syndicate or its assigns to obtain letters patent in the United States of America and the Dominion of Canada, the Republic of Mexico, the Republic of Cuba and the Philippine Islands for such improvements, additions and new discoveries.

6. The Syndicate shall with all convenient speed and at cost price communicate to the Company or its assigns all improvements, additions and new discoveries which it shall make or acquire or be interested in either alone or jointly with others in connection with any of the inventions comprised in the letters patent and applications mentioned in the Schedule hereto and generally in connection with processes and apparatus for separating different pulverulent materials by oil selection gaseous flotation or other surface tension phenomena and shall give to the Company or its assigns as full information as possible as to the exact mode of working and using such improvements additions and new discoveries but any plans drawings and

Plaintiffs' Exhibit No. 288

models required by the Company or its assigns in connection therewith shall be furnished to the Company or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Company or its assigns execute and do all such documents and things as may be requisite for enabling the Company or its assigns to obtain Letters Patent elsewhere than in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba and the Phillipine Islands for such improvements additions and new discoveries.

7. The Syndicate shall not dispute the validity of any of the patents and patent rights for the time being belonging to the Company nor in any manner support any litigation against the Company. The Company and the Syndicate shall mutually assist each other as far as possible (except financially) in all litigation against infringers or alleged infringers of the said Letters Patent or in respect of Letters Patent which may from time to time be held by or belong to either of them. The Company and the Syndicate shall also mutually assist each other in negotiating for the acquisition upon the best possible terms of new inventions and discoveries and patents for the same or improvements thereof by third parties which it may be considered desirable either to acquire or control in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba or the Phillipine Islands or any other part of the world.

8. The Syndicate shall pay all the costs charges and

Plaintiffs' Exhibit No. 288

expenses of and incident to the preparation and execution of this agreement and of the Syndicate's memorandum and Articles of Association and shall also pay all stamps fees and legal and other expenses incident to the formation and registration of the Syndicate.

9. The Syndicate shall cause this Agreement to be duly filed with the Registrar of Companies pursuant to Section 88 of the Companies (Consolidated) Act 1908 and also in the case of shares allotted to nominees shall cause a sufficient contract to be filed constituting the title of such nominees.

IN WITNESS WHEREOF the Companies parties hereto have caused their respective common seals to be hereto affixed the day and year first above written.

THE SCHEDULE ABOVE REFERRED TO

Part 1.

1. The benefit of the following Letters Patent granted in respect of the United States of America.

No.	Date	Name
777273	13/12/04	Cattermole
763259	21/ 6/04	"
763260	21/ 6/04	"
809959	16/ 1/06	E. B. Kirby
838626	18/12/06	"
763749	28/ 6/04	Goyder & Laughton
784999	14/ 3/05	"

Plaintiffs' Exhibit No. 288

models required by the Company or its assigns in connection therewith shall be furnished to the Company or its assigns on payment of out of pocket expenses and shall from time to time at the request and at the expense of the Company or its assigns execute and do all such documents and things as may be requisite for enabling the Company or its assigns to obtain Letters Patent elsewhere than in the United States of America the Dominion of Canada the Republic of Mexico the Republic of Cuba and the Phillipine Islands for such improvements additions and new discoveries.

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838626	18/12/06	"
763749	28/ 6/04	Goyder & Laughton
784999	14/ 3/05	"

Plaintiffs' Exhibit No. 288

No.	Date	Name
864597	27/ 8/07	De Bav ^{fy}
912783	27/ 8/07	"
776145	29/11/04	C. V. Potter
1045970	3/12/12	Potters. S. O. T. Co.
ser		
683005	11/ 3/12	L. Bradford
793808	4/ 7/05	Sulman & Picard
788247	25/ 4/05	Cattermole Sulman & Picard
777274	13/12/04	"
879985	25/ 2/08	H. L. Sulman
835120	6/11/06	Sulman, Picard & Ballot
835143	6/11/06	H. L. Sulman
835479	6/11/06	Sulman, Picard & Ballot
902018	27/10/08	H. L. Sulman & E. A. Sulman
⁶ 9 2678	28/ 6/10	Greenway Sulman & Hig- gins
953746	5/ 4/10	T. J. Hoover
ser		
587621	17/10/10	Greenway & Lavers
ser		
647239	1/ 9/11	Nutter & Lavers
ser		
636245	30/ 6/11	H. H. Greenway
ser		
665900	4/12/11	E. H. Nutter
ser		
651188	25/ 9/11	Nutter & Hoover

Plaintiffs' Exhibit No. 288

No.	Date	Name
ser		
712309	30/ 7/12	Chapman & Tucker
ser		
723327	1/10/12	J. Hebbard
738586	26/12/12	Chapman & Tucker
ser		
732386	19/12/11	A. C. Howard
955012	12/ 5/10	H. L. Sulman
979857	27/12/10	T. J. Hoover
		Broadbridge & Howard
ser		
768374	17/ 4/13	Greenway & Lowry
ser		
766250	8/ 5/13	Chapman

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such Patents as aforesaid.

Part 2.

1. The benefit of the following Letters Patent granted in respect of the Dominion of Canada viz:—

No.	Date	Name
87785	14/ 6/04	Cattermole
87786	14/ 6/04	"
76621	8/ 7/02	C. V. Potter
121676	2/11/09	Potter S. O. T. Co. (T. J. Greenway)
169146	13/ 3/12	"
87700	7/ 6/04	Sulman & Picard

Plaintiffs' Exhibit No. 288

No.	Date	Name
94516	1/ 8/05	Cattermole Sulman & Picard
96183	21/11/05	Sulman Picard & Ballot
96182	21/11/05	"
99743	26/ 6/06	"
127397	9/ 8/10	Greenway Sulman & Hig- gins
129819	13/12/10	T. J. Hoover
134271	11/ 7/11	Greenway & Lavers
135089	22/ 8/11	Sulman & Picard
137404	19/12/11	Nutter & Lavers
142607	3/ 9/12	H. H. Greenway
ser		
166434	18/11/11	Nutter & Hoover
147431	22/ 4/13	Chapman & Tucker
ser		
176341	17/ 1/13	J. Hebbard
ser		
175775	26/12/12	Chapman & Tucker
147432	22/ 4/13	A. C. Howard
94718	15/ 8/05	S. S. & Steele
129820	13/12/10	T. J. Hoover
		Broadbridge & Howard
ser		
179523	21/ 5/13	Greenway & Lowry

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

Plaintiffs' Exhibit No. 288

Part 3.

1. The benefit of the following Letters Patent granted in respect of the Republic of Mexico.

No.	Date	Name
3397	15/12/03	Cattermole
4268	12/ 1/05	De Bavay
4267	12/ 1/05	"
4269	12/ 1/05	"
3605	24/ 3/04	C. V. Potter
9362	14/ 7/09	Potter S. O. T. Co.
12781	12/ 3/12	Potter S. O. T. Co.
3276	19/10/03	Sulman & Picard
3642	12/ 4/04	Cattermole Sulman & Picard
4908	14/ 9/05	Sullman Picard & Ballot
5560	21/ 4/06	
4907	14/ 9/05	" "
5561	21/ 4/06	" "
4622	27/ 5/05	S. Steele & Steele
4635	1/ 6/05	"
5603	26/ 4/06	Sulman Picard & Ballot
5602	26/ 4/06	"
9422	26/ 7/09	Minerals Separation Ltd.
9592	9/ 9/09	"
11087	19/10/10	"
11898	20/ 7/11	"
11943	6/ 7/11	"
12291	31/10/11	"
12050	11/ 8/11	"

Plaintiffs' Exhibit No. 288

No.	Date	Name
12290	31/10/11	Minerals Separation Ltd.
13316	14/ 8/12	"
13820	8/ 1/13	"
13749	17/12/12	"
13991	6/ 3/13	"

Broadbridge & Howard
Greenway & Lowry

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

Part 4.

1. The benefit of the following letters Patent and application for Letters Patent granted in respect of the Republic of Cuba, viz:

No.	Date	Name
1521	2/ 5/11	Minerals Separation Ltd.
1520	2/ 5/11	"

Application for patent filed 26/3/13

2. The benefit of all extensions and prolongations of the terms and privileges granted by any such patents as aforesaid.

The Common seal of Minerals
Separation Ltd. was hereto
affixed in the presence of

John Ballot
W. W. Webster

Directors (Seal)
E. Williams Secretary

Plaintiffs' Exhibit No. 288

The Common Seal of Minerals
Separation American Syndi-
cate (1913) Limited was
hereto affixed in the pres-
ence of

Emil Beer

H. A. Krohn

Directors (Seal)

E. Williams Secretary

A true copy

Geo. J. Sargent

Assistant Registrar of Joint Stock Companies

(Stamp)

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 289.

BILL OF SALE

From

MINERALS SEPARATION AMERICAN SYNDI-
CATE (1913), LIMITED,

To

MINERALS SEPARATION NORTH AMERICAN
CORPORATION.

Know all men by these presents

That MINERALS SEPARATION AMERICAN SYNDICATE (1913), Limited, a company incorporated under the Companies Consolidated Act 1908, having its registered office at No. 62 London Wall, in the City of London, England, for and in consideration of five hundred thousand (500,000) shares, without nominal or par value, of the stock of Minerals Separation North American Corporation, a corporation duly organized and existing under the laws of the State of Maryland, whose principal office is in the Continental Building, in the City of Baltimore, in the State of Maryland, of the assumption by said Minerals Separation North American Corporation of all the debts, liabilities and obligations, contractual or otherwise, of said Minerals Separation American Syndicate (1913), Limited, and for other valuable considerations to it moving by said Minerals Separation North American Corporation, the receipt whereof

Plaintiffs' Exhibit No. 289

is hereby acknowledged, has bargained, sold, assigned, transferred and set over, and by these presents does bargain, sell, assign, transfer and set over to said MINERALS SEPARATION NORTH

Page 2.

AMERICAN CORPORATION, all the patents (subject, however, to all licenses, rights and options heretofore granted in respect thereto), processes, licenses, inventions, applications for patents and all rights, contracts, agreements, concessions, privileges, shares of the capital stock of corporations now owned by said Minerals Separation American Syndicate (1913), Limited, and all the right, title and interest in and to patents (subject, however, to all licenses, rights and options heretofore granted in respect thereto), processes, licenses, inventions and applications for patents, and all rights, contracts, agreements, concessions, privileges, shares of the capital stock of corporations to which said Minerals Separation American Syndicate (1913), Limited, is now or to which it shall hereafter become entitled by virtue of any existing agreements or otherwise, and all the cash on hand and in banks, whether in the Kingdom of Great Britain, the United States of America, or elsewhere, promissory notes, bills of exchange, drafts, outstanding accounts, bills receivable, moneys due and to grow due, royalties due and to grow due, claims and demands ~~and royalties due and to grow due, claims and demands~~ and things in action, office furniture and

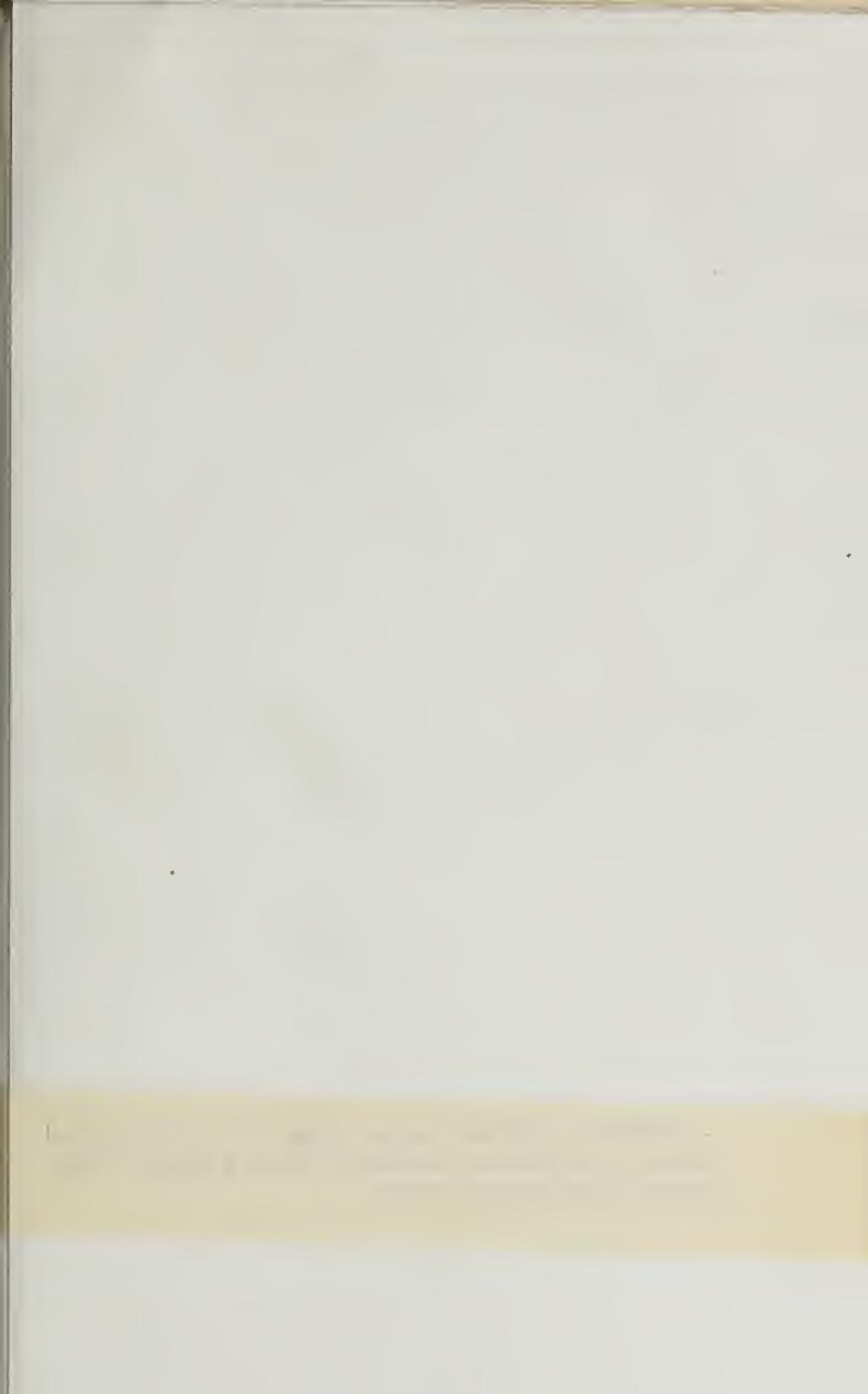
Plaintiffs' Exhibit No. 289

fixtures and other chattels, and all the business, property and assets of Minerals Separation American Syndicate, (1913), Limited, of every sort, nature or description, including the good will of its business, as a going concern;

TO HAVE AND TO HOLD the same unto MINERALS SEPARATION NORTH AMERICAN CORPORATION, its successors and assigns, to its and their own use absolutely and forever; SUBJECT, HOWEVER, to the payments, discharges and performances as the case may be, of all the debts, liabilities and obligations, contractual or otherwise, of Minerals Separation American Syndicate (1913) Limited.

Page 3.

And for the considerations aforesaid, said Minerals Separation American Syndicate (1913), Limited, covenants and agrees with said Minerals Separation North American Corporation and its successors and with all and every person or persons whomsoever lawfully or equitably deriving any estate, right, title or interest of, in or to the property hereby sold, assigned and transferred, that it shall and will at any time or from time to time hereafter, upon request of said Minerals Separation North American Corporation, its successors or assigns, make, do, execute, acknowledge or deliver, or cause to be made, done, executed, acknowledged or delivered, all and every such



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P. 5474, L. 27, after " assigns " insert " but at the cost and expense of said Minerals Separation North American Corporation, its successors or assigns,"

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Plaintiffs' Exhibit No. 289

further and other lawful acts, deeds, bills of sale, transfers, assignments and assurances in the law, whether in the United States of America, Kingdom of Great Britain or any other country, for the better and more effectual vesting and confirming the property hereby bargained, sold, assigned, transferred and set over, or so intended to be, in and to said Minerals Separation North American Corporation, its successors and assigns forever, as by said Minerals Separation North American Corporation, its successors or assigns, or its or their counsel learned in the law shall be reasonably advised or required.

Annexed hereto, marked "A" and made part hereof, is a partial list of the patents and applications either owned by the Minerals Separation American Syndicate, (1913), Limited, the vendor corporation, or in or to which it has any right, title or interest, and which is part of the property hereby transferred or intended so to be.

Annexed hereto and made part hereof and marked "B" is a partial list of the licenses granted in respect of the

Page 4

patents either owned by the Minerals Separation American Syndicate (1913), Limited, the vendor corporation, or in which patents it has any right, title or interest.

IN WITNESS WHEREOF, MINERALS SEPARATION AMERICAN SYNDICATE (1913), LIM-

Plaintiffs' Exhibit No. 289

ITED, has caused its name to be hereto affixed by John Ballot, its duly constituted Attorney in Fact, under and by virtue of a Power of Attorney dated October 11, 1916.

Minerals Separation American Syndicate
(1913) Limited.

by John Ballott

Its Attorney in Fact.

STATE OF MARYLAND,
CITY OF BALTIMORE—ss.

ON DECEMBER 7th, 1916 before me personally came JOHN BALLOT, the Attorney-in-Fact of Minerals Separation American Syndicate (1913), Limited, a Company organized under the laws of Great Britain, to me personally known and known to me to be the individual described in and who as such Attorney executed the within instrument and acknowledged that he executed the same as the act and deed of Minerals Separation American Syndicate (1913), Limited therein described by virtue of a Power of Attorney duly executed by said Minerals Separation American Syndicate (1913) Limited, bearing date October 11, 1916, which Power of Attorney was exhibited to me.

Emma L. Burke

(Seal)

Notary Public.

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PATENTS GRANTED IN RESPECT OF THE
UNITED STATES OF AMERICA.

No.

763259	Classifier
763260	Separator and Classifier
763749	Separation of Minerals
776145	Potter
777273	Separator
777274	Soap and Granulation
784999	Separating and Concentrating
788247	Soap and Flotation
793808	Air bubbles
809959	Kirby Separator
835120	Oleic Acid Froth
835143	Boiling
835479	Super-Aerator
838626	Kirby Separator
864597	De Bavay
879985	Table Flotation
902018	Buddle
912783	De Bavay
953746	Froth Apparatus with Baffle
955012	Alcohol
962678	Solution
979857	Frothing Apparatus Agita- tor as Pump
1045970	T. J. Greenway
1064209	Staggered Spitz

Plaintiffs' Exhibit No. 289

1064723	Essential Oils
1067485	Fractional Flotation
1070784	Controlling the Flow of thick pulpy material
1079107	Sodium Bisulphate
1084196	Open Spitz
1084210	Agitator
1093463	Froth Trap
1099699	Copper Ores without Acid
1101506	Bradford
1102873	Doctored Water
1102738	Bi-chromate

Page 6.

PATENTS GRANTED IN RESPECT OF THE
UNITED STATES OF AMERICA.

No.	
1102874	Modifying during Grinding
1142821	Alkali & Bi-chromate
1142822	Littleford
1155815	Sub-Aerator
1155816	Sub-Aeration Apparatus
1155836	Owen's Apparatus
1155861	Bubble Separation without oil
1170665	Acid Sludge
1170637	Sulphuric Acid Compounds
1157176	Owens Permanganate

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APPLICATIONS.

Ser. No.

262890 Air Flotation without oil
(abandoned)

No.

76634 ⁶ Metallic Sulphides
793270 Steam Spray
800966 Ferric Chloride
808986 Copper Precipitant
824765 Alkaline Float
831939 Flotation Process by Sub-
Aeration
835812 Owen's Selective Flotation
843304 Sodium Carbonate
845086 Copper Precipitant

Ser No.

858737 Insufficient Acid

No.

858738 Insufficient Frothing Agent
863097 Classifying
863098 Sizing
864230 Argol
872470 Aqueous Extract of Oil
14015 Electrical Relations (1)
20815 Hebbard's Coke
27098 Concentrated Alkali
34644 Electrical Relations (2)
37350 Seale & Shearshear
39927 Metallic Sulphides
40847 Bleaching Powder
766346 Metallic Sulphides

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APPLICATIONS.

Ser. No.	74921	Martin's Inventions
"	74922	Martin's Inventions
"	91873	Horizontal Agitator
"	94339	Caustic Alkalis
"	105916	

Divisional	}	Electrical Relations (1)
from		
Ser. No. 14015		
Ser. No. 108208		
Ser. No. 108209	}	

Divisionals	}	Metallic Sulphides
from		
Ser. No. 766346	}	

Divisional	}	Alkaline Float
from		
Ser. No. 824765		

PATENTS GRANTED IN RESPECT OF THE
DOMINION OF CANADA

No.	
76621	Potter
87700	Air Bubbles
87785	Separator
87786	Classifier
94332	Di-electric Separator (Abandoned)

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94516	Soap
94718	Concentrating Table
86182	Oleic Acid Froth
96183	Air Flotation
99743	Super-Aerator
121676	Potter's S. O. T. Limited (Abandoned)
127397	Solution
129819	Froth Apparatus with Baffle
129820	Agitator as Pump
134271	Essential Oils
135089	Livening Oxidised Ores
137404	Fractional Flotation
142607	Copper Ores without Acid

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PATENTS GRANTED IN RESPECT OF THE
DOMINION OF CANADA.

No.	
147431	Sodium Bisulphate
147432	Agitator
148275	Froth Trap
151479	Open Spitz
151480	Bi-chromate
151619	Bradford
151810	Steam Spray
157488	Modifying during Grinding
157603	Metallic Sulphides
157604	Copper Precipitant
160692	Staggered Spitz

Plaintiffs' Exhibit No. 289

160693	Ferric Chloride
160694	Sub-Aerator
160846	Alkali & Bi-chromate
160847	Sodium Carbonate
160848	Insufficient Frothing Agent
160849	Insufficient Acid
160850	Alkaline Float
163608	Doctored Water
163707	Hebbards Coke
164587	Bubble Separation Without Oil
165390	Bleaching Powder
163936	Owen's Selective Flotation
166415	Electrical Relations (1)
167474	Sulphuric Acid Compounds
167603	Acid Sludge
167475	Concentrated Alkali
167476	Seale & Shellshear
160937	Owen's Permanganate
151810	Steam Spray
157604	Copper Precipitant
163936	Owen's Selective Flotation

APPLICATIONS

Ser. No.	202962	Caustic Alkalis
" "	204309	Soap Froth

Plaintiffs' Exhibit No. 289

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PATENTS GRANTED IN RESPECT ^{of} ~~TO~~ THE
REPUBLIC OF MEXICO

No.

3276	Air Bubbles
3397	Separator & Classifier
3605	Potter
3642	Soap
4267	Amalgamation Agreement
4268	"
4269	"
4622	Di-Electric Separator
4635	Concentrating Table
(4907	Oleic Acid Froth
Re-issue (5561	"
(4908	Air Flotation
Re-issue (5560	"
5602	Super-Aerator
5603	Cylinder & Selective Flotation
9362	Potter's S. O. T., Ltd.
9422	Solution
9592	Froth Apparatus with Baffle
11087	Essential Oils
11943	Livening Oxidised Ores
11989	Frothing apparatus Agitator as Pump
12050	Copper Ores without Acid
12290	Froth Trap
12291	Fractional Flotation

Plaintiffs' Exhibit No. 289

12781	Potter's S. O. T., Ltd.
13316	Sodium Bisulphate
13749	Howard's Agitator
13820	Doctored Water
13991	Staggered Spitz
14196	Bi-chromate
14208	Metallic Sulphides
14344	Open Spitz
14537	Modifying during grinding
14696	Steam Spray
14749	Ferric Chloride
14833	Sub-Aerator
14862	Copper Precipitant
14980	Owen's Selective Flotation

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PATENTS GRANTED IN RESPECT OF THE
REPUBLIC OF MEXICO

No.	
15030	Alkaline Float
15160	Alkaline & Bi-chromate
15223	Insufficient Acid
15277	Insufficient Frothing Agent
15292	Sodium Carbonate
15513	Bubble Separation without Oil
15523	Sulphuric Acid Compounds
15524	Acid Sludge
15549 bis	Electrical Relations
15598	Hebbard's Coke
15656	Concentrated Alkali

Plaintiffs' Exhibit No. 289

15618	Bleaching Powder
15625	Seale & Shellshear
15029	Owen's Permanganate
14537	Modifying during Grinding
14696	Steam Spray
14749	Ferric Chloride
14833	Sub-Aerator
14862	Copper Precipitant
15160	Alkali & Bi-chromate
15223	Insufficient Acid
15549 bis	Electrical Relations (1)
15656	Concentrated Alkalis
16003	Caustic Alkalis

PATENTS GRANTED IN RESPECT OF THE
REPUBLIC OF CUBA

No.

1520	Frothing Apparatus Agitator as Pump
1521	Alcohol & Solution
1946	Doctored Water
1976	Modifying during grinding
2116	Copper Precipitant

Plaintiffs' Exhibit No. 289

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B.

Various Licenses Granted.

Name of Licensee.	Date of License.
Cuba Copper Co.	25th June 1912
Britannia Mining & Smelting Co.	19th November 19
Silverton Mines	16th January 1913
Ducktown Sulphur, Copper & Iron Co.	27th February 191
Inspiration Copper Co.	10th April 1913
Colusa Parrot Mining & Smelting Co.	7th May 1913
Elm Orlu Mining Co.	7th May 1913
Wm. MacDonald & Louis S. Noble	13th May 1913
Atlas Mining & Milling Co.	22nd May 1913
Consolidated Arizona Smelting Co.	19th September 19
Old Dominion Copper Mining & Smelting Co.	26th September 191.
M. W. Atwater	6th February 191.
Flint Mines Ltd.	16th February 1914
Mountain Copper Co.	11th March 1914
Mond Nickel Co., Ltd.	30th April 1914
Mineral Recovery Co.	19th May 1914
Phelps, Dodge & Co.	11th June 1914
Engels Copper Mining Co.	18th June 1914
Standard Silver Lead Mining Co.	24th June 1914
Cusi Mining Co.	22nd January 1915
Anaconda Copper Mining Co.	1st February 1915
Weedon Mining Co.	3rd June 1915
Arizona Copper Co., Ltd. (Registered in England)	11th June 1915
St. Joseph Lead Co.	16th August 1915
Doe Run Lead Co.	16th August 1915
Utah Leasing Co.	24th August 1915
Portland Gold Mining Co.	29th November 1915
Chichagoff Mining Co.	29th November 1915
Desloge Consolidated Lead Co.	1st January 1916.
Sociedad Anonima des Metals, Brockmann & Co., Inc.	March 1916
Broadwater Mills Co.	14th March 1916

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Name of Licensee.	Date of License.
Arizona Copper Co. (Regd. Clifton Greenlee Co. Arizona)	21st March 1916
Arizona Cananea Copper Co.	12th May 1916
Indicator Consolidated Gold Mining Co.	26th June 1916
William Kent.	1st July 1916
Inland Valley Mining & Develop. Co. P. L.	10th August 1916
Phoenix Co.	15th August 1916

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 290.

$$\begin{array}{l} \text{Tons of Flot. Hds.} \quad \text{Cu Assay} \quad \text{lbs. Cu in Head} \\ 9794 \times .0777 \times 2000 = 1,521,988 \end{array}$$

$$\begin{array}{l} \text{Tons of Flot. Conc.} \quad \text{lbs Cu in Conc.} \\ 2884 \times .2603 \times 2000 = 1,501,410 \end{array}$$

$$\frac{1,501,410}{1,521,988} \times 100 = 98.65$$

Recovery expressed in % = 98.65

$$9794 - 2884 = 6910 \text{ Tons of Tailings}$$

$$1,521,988 - 1,501,410 = 20,578 \text{ lbs. Cu in Tails}$$

$$20,578 \div 6910 \div 20 = .149 \text{ \% Cu in Tails}$$

$$20,578 \div 9794 = 2.10 \text{ lbs. of Cu in Tailings} \\ \text{per ton of Heading}$$

2.1 lbs. of Cu at

Plaintiffs' Exhibit No. 291.

Date: June 24th, 1914.

Parties: Standard Silver-Lead Mining Company, A
Washington State Corporation, with place of busi-
ness at Spokane, Wash.

Mines and Mills at Silverton in the Province of British
Columbia, Canada.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty
on the total mineral products recovered in all concen-
trates produced One and 25/100 (\$1.25 dollars per
ton of two thousand (2,000) pounds of zinc concen-
trates net dry weight; such royalty to be payable for
the entire period during which concentrates are pro-
duced. (Balance the same as in printed form)

Payments: London

Staff Members: One at £60 per month.

Contract: England

Signatories:

Standard Silver-Lead Mining Co.,

By W. J. C. Wanifuid,

Attest: As its President

Charles Hussey, as its Secretary

For Minerals Separation, Ltd.,

John Ballot,

T. Herbert Curle

} Directors

A. O. Williams, Secretary.

English acknowledgement: August 28th, 1914.

American acknowledgement: July 7th, 1914.

(New Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: February 1914.

Parties: The Flint Mines Limited, a New York corporation, having office at 43 Wall Street, New York, with Mines and Mills situated in the Owyhee County in the State of Idaho.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of $2\frac{1}{2}\%$ (two and one half per cent) of the value of the Silver, less five ounces, and $2\frac{1}{2}\%$ (two and one half per cent) of the value of any Antimony paid for less eight units and 25 (twenty five) cents per ounce of saleable gold contained in the (balance of clause as in printed form.)

Payments: London or New York

Staff Members: One at £60 per month.

Contract: New York Contract

Signatories:

The Flint Mines Limited.

By Hugh Morgan, Jr., Secretary.

Attest: Hugh Morgan, Jr., Secy.

For Minerals Separation, Ltd.,

John Ballot, }
H. A. Krohn, } Directors.

A. O. Williams, Secretary.

English acknowledgement: February 16th, 1914.

American acknowledgement: March 3rd, 1914.

(New Form)

Plaintiffs' Exhibit No. 291

English Acknowledgement of date May 29, 1914.

American Acknowledgement, of date May 2nd, 1914.

New Form

ABSTRACT

Date: June 14th, 1914.

Engels Copper Mining Company, No. 393 Mills Building, San Francisco, California.

Operations in Plumas County, California, known as Engels Mines.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total amount of ore milled at the rate of twelve cents for each short ton (2,000) lbs. (dry weight) of crude ore milled when said ore contains not more than two and one-half per cent. ($2\frac{1}{2}\%$) of copper; and fifteen cents for each such short ton of crude ore milled when said ore contains more than two and one-half per cent. ($2\frac{1}{2}\%$) of copper; such royalty to be payable for the entire period during which ~~the~~ concentrates are produced from the ore of said mines by the use of any of the said inventions improvements additions and discoveries, (Balance as in printed form)

Payments: London or New York

Staff Members:: One or more at £60 per month

Contract: To be construed as New York contract

Signatories:

Engels Copper Mining Company

By Henry Engels, its President

Elmer E. Ganton, its Treasurer

Attest Landon A. Bell, Secretary

Plaintiffs' Exhibit No. 291

For Minerals Separation, Ltd.

W. W. Webster Directors

H. A. Krohn

A. O. Williams, Secretary.

English acknowledgement, June 18, 1914.

American Acknowledgement June 3, 1914.

Attached, Letter of June 23rd, 1914. (See copy)

New Form

COPY

London, June 23rd, 1914.

Engels Copper Mining Company,

San Francisco, Calif.

Dear Sirs:

Referring to the license agreement between our Company, Minerals Separation, Limited, and you, we hereby consent—

1st. That the closing sentence of paragraph 3 of said license, reading as follows; "The Licensee shall not, without the consent of the Licensors during the continuance of this license, use or employ any improvement, modification, or addition to any of the inventions specified in the Letters Patent within this license, which said improvement, modification or addition is not the property of the Licensors", shall not preclude the Licensee from using at any time during the term of the license any smelting, leaching or other process for extracting ores which is not essentially a flotation process or an oil concentration process and which does not infringe any of the patents under which said license is granted.

Plaintiffs' Exhibit No. 291

2nd. That we hereby guarantee to the Engels Copper Mining Company that, should we make any change in our basis of computing royalties tending to reduce the same, or make any general royalty reductions, that you shall have the benefit of such reductions in so far as they may apply to the ores produced at your mines;

3rd. It is understood that we will make no objection at any time to your shipping direct and without the payment of any royalty to us such high grade ores as you may desire to ship without treatment by any of our processes.

Very truly yours,

(Sgd) W. W. Webster

H. A. Krohn, Directors

A. O. Williams, Secretary

(Seal)

(M. S. Ltd.)

ABSTRACT

Date: February 6th, 1914.

Maxwell W. Atwater, of Butte, Silver Bow County, Montana.

Dumps and mills at Basin, Jefferson County, Montana.

Location: In or near Basin, Jefferson County, Montana. Known as the zinc Tailings Dumps on the property owned or controlled by the Licensee at Basin, Montana.

Royalty Clause:

The licensee shall pay to the licensors a royalty on

Plaintiffs' Exhibit No. 291

the total mineral products recovered in all concentrates produce^d from said tailings dumps as follows: One and 25/100 (\$1.25) Dollars per ton of two thousand (2,000) pounds of zinc concentrates net dry weight; such royalty to be payable for the entire period during which concentrates are produced from said tailings dumps, by the use of any of the said inventions improvements additions and discoveries. (Balance as printed in later form)

Payments: At London or New York

Staff Member: To be furnished at £60 per month

Contract: To be construed as New York contract

Signatories:

John Balot) Directors

H. A. Krohn)

A. O. Williams, Secretary

M. W. Atwater

English acknowledgement of date March 2, 1914

American acknowledgement of date February 6th,
1914.

New Form

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: May 13th, 1913

Parties: Mineral Separation Limited and WILLIAM B. McDONALD of Leadville, Colorado (Box 566) and LOUIS S. NOBLE of 932 Equitable Building, Denver, Colorado.

Property: The Page-Harrigan Dumps (estimated fourteen thousand tons) located in **S**tray Horse Gulch; the Resurrection Dump (estimated thirty thousand ton) located at Little Ellen Hills and the ore now developed (estimated twenty five thousand tons) in Resurrection Mine Leadville, Colorado, and for no other purpose.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of two (2) cents per unit for each unit of zinc contained in said concentrates in excess of eight (8) units a unit being twenty (20) pounds in each ton of two thousand (2,000) pounds of dry weight of concentrates and at the same rate two (2) cents per unit for each such unit of lead contained in said concentrates in excess of eight (8) such units and also two and one half per centum ($2\frac{1}{2}\%$) of the value of all other products contained in said concentrates as paid for by the smelter on concentrates produced by the use of any of the inventions specified in the said Let-

Plaintiffs' Exhibit No. 291

ters Patent or by the use ^{of} any improvements or modifications thereof, or additions thereto, or any new patents granted in connection therewith.

Payments: New York and London

Staff Member: \$250.00 per month for six months.

Contract: Under the laws of England.

Signatories:

For the Minerals Separation,

John Ballot,

T. Herbert Curle. Directors.

A. O. Williams Secretary.

Wm. B. McDonald, and

Louis S. Noble

Witnesses: Harold C. Hankins,

William J. Walton.

Old Form

ABSTRACT

Date: February 27th, 1913.

The Ducktown Sulphur Copper and Iron Company
~~ore now developed (estimated twenty-five thousand~~
Limited, No. 1 Gresham House, Old Broad Street,
London.

Property in the State of Tennessee, U. S. A. only.

Royalty Clause:

The Licensee shall pay to the Licensors ^{royal}ties at the following rates namely:—Six cents per twenty pounds copper in concentrates produced—two and a half per cent value of saleable silver in concentrates

Plaintiffs' Exhibit No. 291

in concentrates produced and twenty five cents per ounce of saleable gold of concentrates produced with a minimum in any case of twelve cents per ton of ore treated by and with the use of any of the inventions specified in the said Letters Patent or by or with the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith.

Payments: London

Staff Member: £60 per month, six months.

Contract under laws of England

Signatories:

For Minerals Separation

John Ballot

Francis L. Gibbs, Directors

A. O. Williams, Secretary

DUCKTOWN SULPHUR COPPER AND IRON
COMPANY LIMITED

Lewis S. Mortimer

Edward Derby Directors

W. Berny, Secretary

Old Form

ABSTRACT

Date: March 11th, 1914.

Parties: Minerals Separation Limited and The Mountain Copper Company Limited, whose registered office is situated at 3 Lombard Street London, E. C. (hereinafter called "the Licensees") of the other part.

Plaintiffs' Exhibit No. 291

Property situate in Shasta County, California, known as the Iron Mountain Mines, but not elsewhere.

Royalty Clause:

The licensees shall pay to the Licensors a royalty on the total amount of ore milled at the rate of Twelve cents for each short ton (Two thousand pounds dry weight) of crude ore milled when said ore contains less than two per cent (2%) of copper and fifteen cents for each such short ton of crude ore milled when said ore contains two per cent (2%) or more of copper; such royalty to be payable for the entire period during which concentrates are produced from the ore of the said mines by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith. (Balance the same as printed form)

Payments: London or New York

Staff Members: One at rate of £60 per month.

Contract: English contract.

Signatories.

The Mountain Copper Company Limited,
N. M. MacDonald, Director.
A. N. Freuer, Secretary.

For Minerals Separation, Ltd.,

John Ballot,
Francis L. Gibbs, Directors.
A. O. Williams, Secretary

(Old Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: May 22nd, 1913.

Parties: The Atlas Mining & Milling Company, a Colorado corporation, with registered office at Ouray, Colorado.

Operations in State of Colorado, at Atlas Mines.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total mineral products recovered in all concentrates or bullion produced from the ore of said mines as follows: Two and one half ($\frac{1}{2}\%$) per cent of the value of the silver in said concentrates or bullion as paid for by the smelters ~~or in said concentrates or bullion as paid for by the smelters~~ or mint; twenty five (25) cents per ounce for all gold contained in said concentrates or bullion; two (2c) cents per unit for each unit of lead contained in said concentrates in excess of eight units, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates; six (6c) cents per unit for each such unit of copper contained in said concentrates, if paid for by the smelter; two (2c) cents per unit for each such unit of zinc contained in said concentrates in excess of eight units, if paid for by the smelter; provided, however, that such payment on concentrates or bullion produced shall not be less than twenty five (25c) cents for each short ton (2000) dry weight, of crude ore produced from said mine such royalty to be payable

P. 5501, L. 3, after "any" insert "of the inventions specified in the said letters patent, by the use of any"

P. 5501, L. 22, insert:

"For Minerals Separation, Ltd.,
John Ballot,
Francis L. Gibbs, Directors.
A. O. Williams, Secretary."

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Plaintiffs' Exhibit No. 291

for the entire period during which concentrates are produced from the ore of said mines by the use of any of the improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith, provided, however, that in computing said royalty and minimum all ore or said mines which has not been treated or a part or parts or product or products whereof has or have not been treated by the use of any of said inventions shall be excluded from computation. (Balance as in Printed form)

Payments: London or New York

Staff Members: One or more at £50 per month

Contract: Shall be construed as English Contract

Signatories:

(Name of Atlas Mining & Milling Company not affixed)

Wm. Hore, Jr.,

W. D. Shipman, Directors,

C. H. Wagner, Vice President,

Fred Carroll, Secretary.



Attached letter in remodification of terms of royalty.

(Old Form)

Minerals Separation, Limited, et al., vs.

Plaintiffs' Exhibit No. 291

(COPY)

ATLAS MINING & MILLING COMPANY

In letter from Mr. Nutter to the Atlas Mining & Milling Co. of February 10th 1915, he states that Mr. Ballot and Dr. Gregory had agreed and were willing to meet the company as far as possible in the matter of a modification of the terms of the royalty arrangement, and proposed to waive as from January 1st, 1915, the minimum rate of 25c per ton of material treated by the Atlas Co. From that date they will merely pay the unitage royalty on all metal values recovered as per clause 1 of the License, with no fixed minimum per ton of ore treated.

ABSTRACT

Date : May 7th, 1913.

Calusa-Parrot Mining and Smelting Company, (a Washington Corporation) of Butte, Montana.

The Old dump hereinafter described.

The old dump at the Butte Reduction Works, near Butte, Montana, and for no other purpose.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the total mineral products in all concentrates produced from said tailings as follows: Six cents per unit for each unit of copper contained in said concentrates, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates; and two and one half per cent of the value of all silver and

Plaintiffs' Exhibit No. 291

gold, or either silver or gold in said concentrates as paid for by the smelter; such royalty to be payable for the entire period during which concentrates are produced from the said tailings or products thereof by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.

Staff Member: For six months at £60 per month.

Contract under Laws of England.

Signatories:

For Minerals Separation

John Ballot, Director

For Colusa-Parrot

M. C. Messias, Secretary.

Ratified by Colusa Parrott Mining & Smelting Company at a special meeting of the Board of Directors, of date May, 29th, 1913.

(Old Form)

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ABSTRACT

Date: May 7th 1913.

The Elm Orlu Mining Company (a Washington corporation) of Butte, Montana.

The State of Montana, property known as the Elm Orlu Mines.

Use in the Butte District, State of Montana.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty on the mineral products recovered in all concentrates produced from the ore of said Mines, as follows:— two cents per unit for each unit of zinc contained in said concentrates in excess of eight units, a unit being twenty pounds in each ton of two thousand pounds dry weight of concentrates, six cents per unit for each unit of copper contained in said concentrates; two and one-half per cent. of the value of the silver in said concentrates as paid for by the smelter; and twenty five cents per ounce for all gold contained in said concentrates; or, at the option of the Licensee to be exercised within sixty (60) days from the day and year first above written, in place of the royalty as above set forth computed on the total mineral products recovered in all of the concentrates, a royalty at the rate of fifty cents per ton of two thousand pounds dry weight of all crude ore produced from said mines; such royalty to be payable for the entire period during which concentrates are produced from the ore of said mines by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements

Plaintiffs' Exhibit No. 291

or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York

Staff Members: One or more at £60 per month for six months.

Contract under laws of England.

Signatories:

For Minerals Separation

John Ballot

H. A. Krohn

A. O. Williams,

Directors

Secretary

Elm Orlu Mining Company

by (sd) W. A. Clark, Vice President

W. D. Mangam, Secretary

Contract ratified by special meeting of Board of Directors of the ELM ORLU MINING COMPANY, of date May 29th, 1913.

(Old Form)

ABSTRACT

Date: September 19th, 1913.

Consolidated Arizona Smelting Company, New York, N. Y.

Property, at Humboldt, Arizona, known as the Humboldt Smelter, and its Mines in Mayer, Arizona, known as the Blue Bell Mine and De Soto Mine.

Said Property and mines, only.

Royalty Clause:

The Licensee shall pay to the Licensors a royalty at

Plaintiffs' Exhibit No. 291.

the rate of Six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs., dry weight) of crude ore milled; and provided further, that for all concentrates produced from old tailings the royalty shall be as above stated except that the provision for the minimum rate of such payment shall not be applicable; such royalty to be paid for concentrates produced by the use of any inventions specified in said Letters Patent or by the use of any improvements or modifications thereof or additions thereto or any new patents granted in connection therewith.

Payments: London or New York

Staff Member: At £60 per month

Contract: Under the laws of England.

Signatories:

For Minerals Separation

John Ballot

W. A. Krohn

Directors

Consolidated Arizona Smelting Company,

Victor T. Ammons,

President

Fred W. Thompson,

Secretary

(Old Form)

P. 5507, L. 9, after "copper" insert "in the concentrates,
a unit of copper"



Plaintiffs' Exhibit No. 291

ABSTRACT

Date: September 26th, 1913

Parties: Old Dominion Copper Mining & Smelting
Company, with office situate at Boston, Mass.

Operations at Globe, Arizona

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of six cents for each unit of copper, being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs. dry weight) of crude ore milled; such royalty to be paid for (Balance same as in printed form.)

Payments: London or New York

Staff Members: One at £50 per month

Contract: As made in England.

Signatories:

For Minerals Separation, Ltd.,

John Ballot, }
H. A. Krohn, } Directors

A. O. Williams, Secretary

Old Dominion Copper Mining & Smelting Co.,

Charles S. Smith, President.

Charles H. Altmill, Secretary.

(Old Form)

See attached letters in re cancellation, of date, June 18,
1914, and July 1st, 1914.

Plaintiffs' Exhibit No. 291

OLD DOMINION COPPER MINING &
SMELTING CO.,
50 Congress Street,
Boston,

June 18, 1914.

Charles S. Smith, President
Charles H. Altmiller, Secy. & Treas.
Telephone Main 6552

Minerals Separation, "Limited,"
62 London Wall,
London, E. C., England.

Gentlemen:

The Old Dominion Copper Mining & Smelting Company, a party to the license agreement between the Minerals Separation, "Limited," (called the Licensors) and the Old Dominion Copper Mining & Smelting Company, (called the Licensees), dated September 26, 1913, hereby notify said Licensors that the Licensees renounce and abandon said license and all rights thereunder; that they refuse to act further under the same and to pay further royalties in connection therewith.

Yours very truly,
CHARLES S. SMITH,
President.

Plaintiffs' Exhibit No. 291

COPY.

REGISTERED:

1st July 1914

M. E. P.

J. B.

Messrs. The Old Dominion Copper Mining & Smelting Co.,

Mr. Charles S. Smith, President,

50 Congress Street,

Boston.

Gentlemen:

I beg to acknowledge receipt of your letter of the 18th June in which you assume to renounce and abandon the license agreement dated the 26th September 1913, between my Company and the Old Dominion Copper Mining and Smelting Co., and in which you notify us of your refusal to act further under the same and to pay further royalties in connection therewith, and I am instructed by my Board to inform you that they have carefully considered the whole matter.

My Board desire to know whether they are right in assuming that you do not intend in the future to use any of my Company's patented inventions.

If you had so intended we agree of course that you are entitled under the License at any time to discontinue the use of our inventions.

But it must be obvious to you that you are not under any circumstances entitled to renounce and abandon the license agreement and should that have been

Plaintiffs' Exhibit No. 291

your intention, my Board hereby notify you that they refuse to accept such renunciation and abandonment.

My Board desire to point out that they have in all respects and in all good faith strictly observed the terms and conditions of the agreement, and will continue to do so, and in the same way they expect you to observe the terms and conditions on your part.

I remain, Gentlemen,

Yours faithfully,

(Sgd) A. O. Williams,

Secretary.

By Order of the Board.

ABSTRACT

Date: April 10th, 1913

Inspiration Consolidated Copper Company, 42 Broadway, New York.

Inspiration Mines, State of Arizona, U. S. A.

Treatment of products of said mines in State of Arizona.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of twelve cents (12c) for each short ton (2,000 pounds dry weight) of ore treated on all tonnages up to and including four thousand (4,000) of such tons per day; at the rate of ten cents (10c) for each such ton of ore treated on all total tonnages of more than four thousand (4,000) and up to and including six thousand (6,000) of such tons per day;

Plaintiffs' Exhibit No. 291

and at the rate of nine (9c) cents for each such ton of ore treated on all total tonnages of more than six thousand (6,000) of such tons per day; such royalty to be computed as of the average treatment for each day in the period of three months preceding a quarter day and to be paid in lawful money of the United States on all ore treated by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York

Staff Member: One or more to be furnished at £60 per month.

Signatories:

John Ballot,	}	Directors
Francis L. Gibbs,		
A. O. Williams,		Secretary

For Inspiration Consolidated Copper Co.

W. D. Thornton,	Vice President
J. W. Allen	Secretary

Contract ratified by resolution of Board of Directors of Inspiration Consolidated Copper Co. of date March 27, 1913.

(Old Form)

Plaintiffs' Exhibit No. 291

ABSTRACT

Date: September 16th, 1913.

Phelps, Dodge & Company, New York, N. Y.

Burro Mountain Copper Company

Treatment of products of said mine.

Royalty Clause:

The Licensees shall pay to the Licensors a royalty at the rate of six cents for each unit of copper in the concentrates, a unit of copper being twenty pounds per short ton (2,000 lbs. dry weight) of the concentrates; two and one-half per cent of the value of the silver in said concentrates as paid for by the smelter; twenty five cents per ounce for all gold contained in said concentrates as paid for by the smelter; provided, however, that such payment shall not be less than twelve cents for each short ton (2,000 lbs. dry weight) of crude ore milled; such royalty to be paid for concentrates produced by the use of any of the inventions specified in the said Letters Patent or by the use of any improvements or modifications thereof or additions thereto, or any new patents granted in connection therewith.

Payments: London or New York.

Staff Member: To be furnished at £50 per month & expenses.

Signatories:

For Minerals Separation, Limited:

John Ballot,

W. A. Krohn,

Directors

A. O. Williams, Secretary

Plaintiffs' Exhibit No. 291

For Phelps, Dodge & Company,

James Douglas

Cleveland H. Dodge

Directors

F. T. Bulmer, Asst. Secretary.

(Old Form)

See copies of attached letters re cancellation of contract.

COPY

PHELPS, DODGE & CO.

Incorporated

99 John Street,

Corner Cliff St.,

New York, June 11th, 1914.

Minerals Separation, Limited,

62 London Wall,

London, E. C., England.

Dear Sirs:

Phelps, Dodge & Co., a party to the license agreement between Minerals Separation, Limited (called the Licensors) and Phelps, Dodge & Co. (called the Licensees) dated September 15th, 1913, hereby notify said licensors that the licensees renounce and abandon said license and all rights thereunder; that they refuse to act further under the same and to pay further royalties in connection therewith.

Yours truly,

PHELPS, DODGE & CO.

Gerry Nortman

Secretary.

5514 *Minerals Separation, Limited, et al., vs.*

Plaintiffs' Exhibit No. 291

COPY

PHELPS, DODGE & CO.
99 John Street, New York,

June 11th, 1914.

Messrs. Beer, Sondheimer & Company,
61 Broadway, City.

Dear Sirs:

Herewith we beg to enclose copy of a letter which we are mailing to-day to the Minerals Separation, Limited, 62 London Wall, London, E. C., England.

Yours very truly,

PHELPS, DODGE & CO.

(sd) George Notman

Secretary

Copy of preceding letter attached.

Plaintiffs' Exhibit No. 291

COPY

MINERALS SEPARATION AMERICAN SYNDI-
CATE, (1913), LTD.

S S Oceanic

New York, June 12th, 1914.

Messrs. Minerals Separation, Limited,
62 London Wall, E. C.

Dear Sirs:

Re: MESSRS. PHELPS, DODGE & COMPANY
Messrs. Beer, Sondheimer & Company to-day re-
ceived a letter with enclosure, as per copy herewith.
I think it will be best simply to acknowledge receipt
and say the matter will be submitted to the Board
at its next meeting as soon as the Chairman returns
to London. I will be in a better position to explain to
the Board on my arrival what has been done here, and
what should be done in London.

Yours truly,

encl.

(SD) John Ballo^t.

COPY

S S OCEANIC

24th June, 1914.

Messrs. Phelps, Dodge & Company, Inc.,
99 John Street,
Corner Cliff Street,
NEW YORK, U. S. A.

Dear Sirs:

We have to acknowledge due receipt of your letter

Plaintiffs' Exhibit No. 291

of 11th June, received under registered cover, which will be submitted to our Board of Directors at its next meeting, as soon as our Chairman returns to London.

We, are, dear Sirs,

Yours truly,

(SGD) A. O. Williams,

Secretary.

COPY

REGISTERED

S S OLYMPIC

1st July, 1914.

Messrs. Phelps, Dodge & Co.,

Mr. George Notman—Secretary,

99 John Street,

NEW YORK, U. S. A.

Gentlemen:

Referring to our previous letter to you of the 24th ultimo, and in further reply to yours of the 11th ultimo in which you assume to renounce and abandon the license agreement dated the 16th September, 1913, between my Company and Messrs. Phelps, Dodge & Co. and in which you notify us of your refusal to act further under the same and to pay further royalties in connection therewith, I am now instructed by my Board to inform you that they have carefully considered the whole matter.

My Board desire to know whether they are right in

Plaintiffs' Exhibit No. 291

assuming that you do not intend, in the future, to use any of my Company's patented inventions.

If you had so intended we agree, of course, that you are entitled under the license at any time to discontinue the use of our inventions.

But it must be obvious to you that you are not under any circumstances entitled to renounce and abandon the license agreement and should that have been your intention, my Board hereby notify you that they refuse to accept such renunciation and abandonment.

My Board desire to point out that they have in all respects and in all good faith strictly observed the terms and conditions of the agreement, and will continue to do so, and in the same way they expect you to observe the terms and conditions on your part,

I remain, Gentlemen,

Yours faithfully,

(Sgd) A. O. Williams, Sec.

By order of the Board

Filed May 18, 1917.

GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 292.

MINERALS SEPARATION
NORTH AMERICAN
CORPORATION
AND

LICENSE

Henry D. Williams,
Attorney and Counselor at Law
61 Broadway,
New York, N. Y.

Plaintiffs' Exhibit No. 292

THIS INDENTURE made the
day of 191 BETWEEN MIN-
ERALS SEPARATION, NORTH AMERICAN
CORPORATION, of 61 Broadway, New York, N. Y.,
(hereinafter called "the Licensors", which designation
shall include its successors and assigns where the con-
text so requires or admits) of the one part and

a corporation organized and existing under the Laws
of
and having an office or place for the transaction of
business situate at

and whose Mines and Mills are at

(hereafter called "the Licensees") of the other part.

WHEREAS the Licensors are entitled to or other-
wise control or are interested in Letters Patent for cer-
tain inventions for the concentration and treatment
of ores described in the Schedule hereto, and are en-
titled to grant licenses thereunder.

AND WHEREAS, the Licensors have agreed to
grant to the Licensees a license to concentrate and
treat all or any ores or any part thereof and or dumps
now existing in accordance with all or any of the in-
ventions, processes and apparatus described and claimed
in the said Letters Patent and any Letters Patent for
the concentration of ores that are or may become the

Plaintiffs' Exhibit No. 292

property of the Licensors (all of said Letters Patent being hereinafter called "Letters Patent within this License") at the premises of the Licensees situate in

and known as the

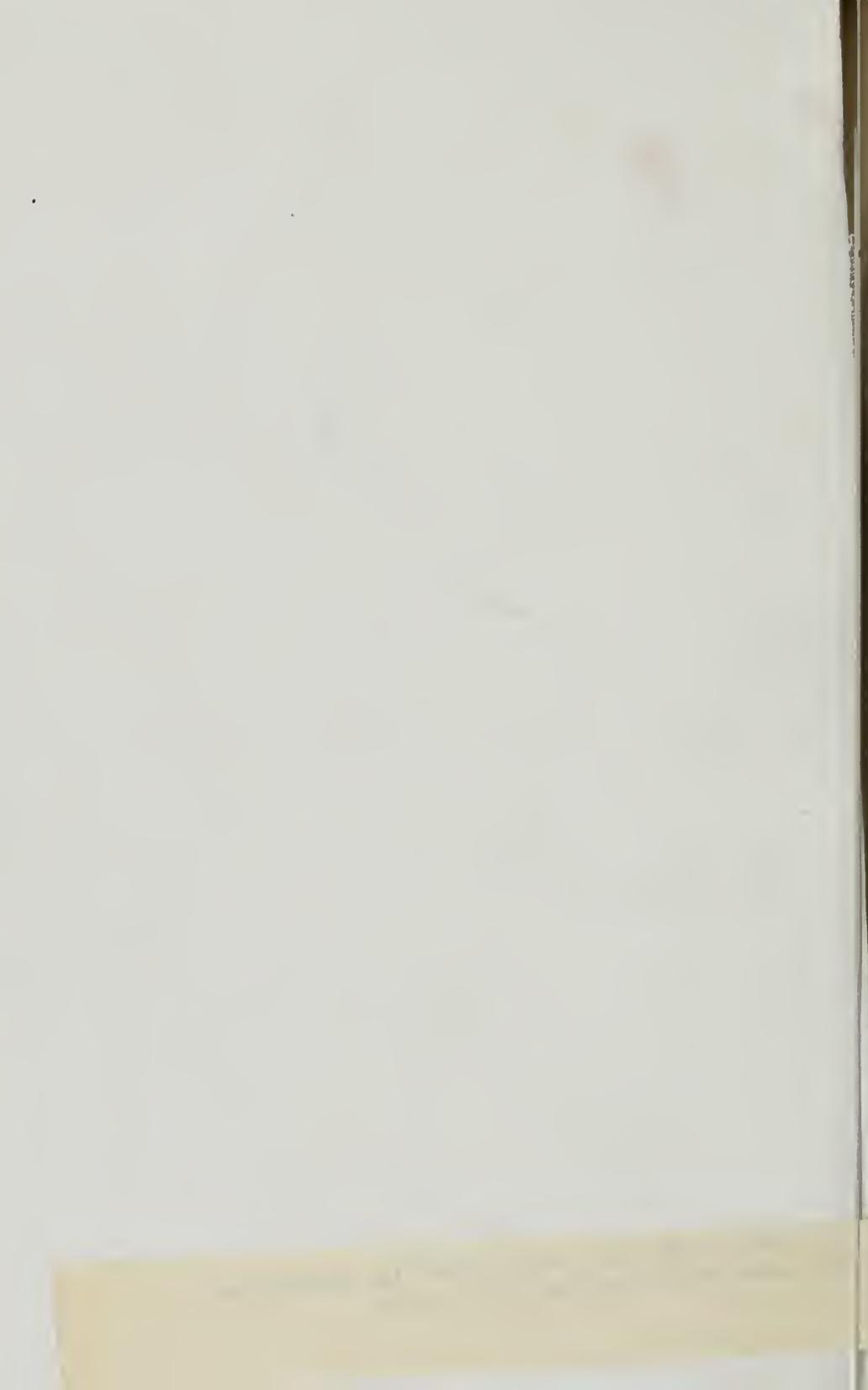
but not elsewhere.

NOW THIS INDENTURE WITNESSETH That in pursuance of the said Agreement and of the matters aforesaid and in consideration of the royalties hereby reserved and of the covenants on the part of the Licensees hereinafter contained the Licensors hereby grant unto the Licensees full license power and authority to make, use and exercise any or all of the inventions described and claimed in the Letters Patent within this license, at the Licensees' mines or mills aforesaid and any extension thereof in

for the purpose of treating all or any of the ores or any part thereof and or dumps now existing, belonging to or controlled by the Licensees won, dug or otherwise produced at the

and to vend the concentrates and other products resulting from the use and exercise of the said inventions during the terms of the Letters Patent within this License or any of them and any ex-

P. 5521, L. 29, after "after" insert "the expiration of
each quarter, viz., within thirty (30) days after "



Plaintiffs' Exhibit No. 292

tension thereof subject nevertheless to the following conditions:—

AND IT IS HEREBY AGREED as follows:—

1. THE Licensees shall pay royalties to the Licensors for the use or the right to use processes and appliances embodying any of the inventions described and claimed in the Letters Patent within this license at a rate

2. THE Licensees shall keep at the counting house or office of their said mines proper books of account and shall enter therein full and complete particulars of all the ores and/or dumps treated including assay values thereof and of the concentrates and tailings produced also including assay values thereof. The said books of account shall at all convenient times be open to the inspection of a chartered or incorporated accountant to be appointed by the Licensors. The Licensees shall quarterly deliver to the Licensors an account in writing showing the quantity, assay and other particulars of the ores and/or dumps treated during each quarter and the quantity, assay, values of metal contents and other particulars of the concentrates or products produced or recovered under this license and the assay of the tailings. The Licensees shall if so required by the Licensors verify the said accounts by affidavit. The said quarterly accounts shall be delivered to the Licensors within thirty (30) days after [^]March 31st, June 30th, September 30th

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and December 31st, starting with the quarter day immediately following the date of this license. The Licensees shall within ten days thereafter pay to the Licensors free of exchange in New York the full amount thereby shown to be due.

3. THE Licensees shall during the continuance of this License promptly communicate and explain to the Licensors every invention or discovery made or used by them which may be an improvement modification or addition to any of the inventions specified in the Letters Patent within this License or may be useful in carrying out any of the processes thereby protected or any addition thereto or modification thereof whether patentable or not which the said Licensees may use or be or become possessed of. All such inventions and discoveries shall so be available for use by the Licensees as if they were contained in the Letters Patent within this License and subject thereto the Licensors shall be entitled to have the full benefit of and if obtainable to obtain Letters Patent for any such improvements or discoveries communicated to them by the Licensees, which said Letters Patent shall be and become the property of the Licensors, and the Licensees shall render all assistance in their power for that purpose, provided that the Licensors shall bear all the charges and expense of obtaining such Letters Patent for all or any of such parts of the world as they may desire to protect or apply for, and such Letters Patent when obtained shall be and become Letters Patent within this License, and the Licensees shall so far as practicable bind their

Plaintiffs' Exhibit No. 292

employees to assign or transfer to the Licensors any inventions made by such employees during their period of employment by the Licensees. The Licensees shall not without the written consent of the Licensors during the continuance of this License use or employ any improvement modification or addition to any of the inventions specified in the Letters Patent within this License which said improvement modification or addition is not the property of the Licensors.

4. THE Licensors shall whenever required (on the Licensees paying out of pocket expenses) give all assistance, information and advice in their power as to the working of any of the said inventions and shall use their best endeavors to enable the Licensees to use and exercise said inventions to the best advantage, and in like manner the Licensees shall use their utmost endeavors to promote the success of the said inventions and enable them to be used and exercised to the best advantage.

5. THE Licensees shall not directly or indirectly during the continuance of this License nor at any time after the determination thereof dispute or object to the validity of the Letters Patent within this License or the novelty or utility of the inventions specified therein.

6. THE Licensees shall not either directly or indirectly during the continuance of the Letters Patent within this License or any of them use the said inventions or processes or any improvement or modification thereof or addition thereto otherwise than in accord-

Plaintiffs' Exhibit No. 292

ance with these presents, and the Licensees hereby undertake and agree that they, their officers and agents, will not in any way directly or indirectly support or assist third or hostile parties in any litigation either against the Licensors or any Licensees of the Licensors or against Minerals Separation, Limited, of London, England, or its subsidiary or associated companies or successors owning patents in the British Empire or any foreign countries for the inventions protected by the Letters Patent within this license, or its or their Licensees, or by the Licensors or said Minerals Separation, Limited, or said ^{other} companies, against others.

7. THE Licensees shall not assign or sublet this License or sell or dispose of any machinery or apparatus the subject matter of any of the said Letters Patent without the written consent of the Licensors such consent not to be withheld in the case of a bona fide sale of the Licensees' undertaking or a substantial part thereof to a responsible person or company who will undertake to enter into a License when called upon so to do by the Licensors in the same terms as near as may be as are herein contained (but subject to the approval of the Licensors) and the Licensors agree to execute if called upon so to do such a License to such bona fide purchaser.

8. THE Licensees shall permit the officers or the duly authorized representatives of the Licensors at all reasonable times during the continuance of this License to enter upon the works and property of the Licensees

Plaintiffs' Exhibit No. 292

and inspect the plant and processes there being used according to the inventions contained in the Letters Patent within this License and to take any samples and to make such assays analyses or tests as may be desirable for the purpose of checking the Licensees' accounts or testing the said plant or processes and will also permit should the Licensors or their agents so desire reasonable access to intending Licensees to see the plant at work.

9. THE Licensees shall at any time if so required supply to the Licensors or their duly authorized representatives full detailed information as to the working of any of the inventions the subject matter of any of the Letters Patent within this License. And the Licensees shall not without the written consent of the Licensors communicate any detail connected with the working of any of the said inventions modifications, additions or improvements to any third party.

10. THE Licensors when required by the Licensees but at the cost of the Licensees shall prepare and supply as soon as may be possible plans and specifications of the plant for the working of the said inventions. The Licensors shall if requested by the Licensees and as soon as may be possible to send to the Licensees' said works an engineer or member of its staff to advise as to the operation of the said inventions. The Licensees shall pay the salary of the said advisor which shall be at the rate of

dollars per month for such period of time as he shall

Plaintiffs' Exhibit No. 292

be engaged in such advisory capacity including the time spent in travel to and from the works of the Licensees, such period of time to be mutually agreed upon, and the Licensees shall pay all legitimate expenses traveling and otherwise of said advisor from the time the said advisor shall start for such works until he shall return therefrom.

11. THE Licensors hereby covenant with the Licensees that the Licensees paying the royalties hereby reserved and observing and performing the covenants on their part herein contained shall at all times during the term of years for which the Letters Patent within this License are granted or any extension thereof peaceably and quietly hold, exercise and enjoy the License hereby granted without any interruption or disturbance by the Licensors or any person lawfully claiming by, through or in trust for them.

12. IN the event of any proceedings being taken against the Licensees for the infringement of any patent rights in the use or exercise of any invention for the time being subject to this License the Licensors shall have the right at their own cost to defend any such proceedings in the name of and on behalf of the Licensees and the Licensees hereby agree to render to the Licensors all possible aid (other than monetary) in connection with such proceedings and to notify immediately the Licensors in writing in the event of any such proceedings being instituted. And the Licensors shall pay all costs charges and expenses incurred by reason of any such proceedings so to be defended and

Plaintiffs' Exhibit No. 292

taken over by them (the Licensors) as aforesaid. Provided that if any proceedings are taken against the Licensees by parties against whom the Licensees are precluded by contractual relations from raising any of the defenses open to them and the Licensors elect to defend such proceedings in the name of the Licensees then the Licensees shall bear and pay all costs and damages in connection therewith.

13. PROVIDED ALWAYS that if any royalties payable hereunder by the Licensees or any part thereof respectively shall remain unpaid for thirty days after the time hereinbefore appointed for payment thereof whether demanded or not or if the Licensees shall make default in any other obligation by them herein contained and in case the non-payment of royalties or of any breach capable of being made good shall for the space of thirty days after they shall have been served with a notice in writing by the Licensors to make good such non-payment or breach neglect or omit so to do or if the Licensees should cease for the period of twelve calendar months to use and work the said inventions or should be wound up by reason of inability to meet their liabilities then the Licensors at any time thereafter and notwithstanding any merely implied waiver by them of their rights so to do may by serving the Licensees or their liquidator (if any) with a notice in writing for this purpose forthwith revoke this License without prejudice however to the recovery by the Licensors of any money then already

Plaintiffs' Exhibit No. 292

STATE OF

County of

} ss.:

On the

day of

in the

year One thousand nine hundred and

before me personally came

to me known, who, being by me duly sworn, did de-
pose and say that he resides in

that he is the _____ of the Minerals
Separation North American Corporation, the licensor
corporation described in and which executed the above
instrument; that he knows the seal of said corpora-
tion; that the seal affixed to said instrument is such
corporate seal; that it was so affixed by order of the
Board of Directors of said corporation, and that he
signed his name thereto by like order; and he acknowl-
edged the said instrument to be the free act and deed
of the said corporation.

STATE OF _____
County of _____ } ss.:

On the _____ day of _____ in the
year One thousand nine hundred and _____

before me personally came

to me known, who, being by me duly sworn, did de-
pose and say that he resides in

that he is the _____ of the

the licensee corporation described in and which executed
the above instrument; that he knows the seal of said
corporation; that the seal affixed to said instrument
is such corporate seal; that it was so affixed by order
of the Board of Directors of said corporation, and that
he signed his name thereto by like order; and he
acknowledged the said instrument to be the free act
and deed of the said corporation.

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order

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Plaintiffs' Exhibit No. 292

THE SCHEDULE ABOVE REFERRED TO UNITED STATES
LETTERS PATENT

Nos.	Date	Name	Description
763,259	June 21, 1904	A. E. Cattermole	Classification of the Metallic Constituents of Ores
763,260	June 21, 1904	A. E. Cattermole	Separation of the Metallic Constituents of Ores from Gangue
763,749	June 28, 1904	Goyder & Laughton	Separation of Minerals
776,145	Nov. 29, 1904	C. V. Potter	Process of Separating Metals from Sulphide Ores
777,273	Dec. 13, 1904	A. E. Cattermole	Separation of the Metallic Constituents of Ores from Gangue
777,274	Dec. 13, 1904	Cattermole, Sulman & Picard	Concentration of Minerals from Ores
784,999	Mar. 14, 1905	Goyder & Laughton	Separating and Concentrating Minerals
788,247	Apr. 25, 1905	Cattermole, Sulman & Picard	Ore Concentration
793,808	July 4, 1905	Sulman & Picard	Ore Concentration
809,959	Jan. 16, 1906	E. B. Kirby	Process of separating minerals
835,120	Nov. 6, 1906	Sulman, Picard & Ballot	Ore Concentration
835,143	Nov. 6, 1906	H. L. Sulman	Ore Concentration
835,179	Nov. 6, 1906	Sulman, Picard & Ballot	Ore Concentration
838,626	Dec. 18, 1906	E. B. Kirby	Separating Tank
864,597	Aug. 27, 1907	A. J. F. DeBavay	Separating Zinc Blende by Flotation
879,985	Feb. 25, 1908	H. L. Sulman	Separation of Metalliferous Minerals from Gangue
902,018	Oct. 27, 1908	H. L. & E. S. Sulman	Ore Concentration
912,783	Feb. 16, 1909	A. J. F. DeBavay	Apparatus for Separating Ores
953,746	Apr. 5, 1910	T. J. Hoover	Apparatus for Ore Concentration
955,012	Apr. 12, 1910	H. L. Sulman	Ore Concentration
962,678	June 26, 1910	Sulman, Greenway & Higgins	Ore Concentration
979,857	Dec. 13, 1910	T. J. Hoover	Apparatus for ore concentration
1,045,970	Dec. 3, 1912	T. J. Greenway	Separation of Metallic Sulphides from Sulphide ores
1,064,209	June 10, 1913	James Hebbard	Apparatus for Ore Concentration
1,064,723	June 17, 1913	Greenway & Layers	Ore Concentration
1,067,485	July 15, 1913	Nutter & Lavers	Ore Concentration
1,071,784	Sept. 3, 1913	E. H. Nutter	Valve for Thick Pulp
1,079,107	Nov. 18, 1913	Chapman & Tucker	Ore Concentration
1,084,196	Jan. 13, 1914	Broadbridge & Howard	Agitating Apparatus
1,084,210	Jan. 13, 1914	A. C. Howard	Agitating Apparatus
1,093,463	Apr. 14, 1914	Nutter & Hoover	Method and Apparatus for ore concentration

Plaintiffs' Exhibit No. 292

Nos.	Date	Name	Description
1,099,699	June 9, 1914	H. H. Greenway	Ore concentration
1,101,506	June 23, 1914	Leslie Bradford	Process and apparatus for separation of metallic sulphide from gangue
1,102,738	July 7, 1914	Greenway & Lowry	Ore concentration
1,102,873	July 7, 1914	Chapman & Tucker	Ore concentration
1,102,874	July 7, 1914	G. A. Chapman	Ore concentration
1,142,821	June 15, 1915	Henry Lavers	Separation of mixed sulphide ores
1,142,822	June 15, 1915	J. W. Littleford	Ore concentration
1,155,815	Oct. 5, 1915	Higgins & Stenning	Apparatus for ore concentration
1,155,816	Oct. 5, 1915	A. H. Higgins	Apparatus for ore concentration
1,155,836	Oct. 5, 1915	T. M. Owen	Apparatus for the concentration of ores
1,155,861	Oct. 5, 1915	L. A. Wood	Ore concentration
1,170,637	Feb. 8, 1916	A. H. Higgins	Ore concentration
1,170,665	Feb. 8, 1916	E. H. Nutter	Ore concentration
1,178,191	Apr. 4, 1916	Sulman & Picard	Copper Precipitant
1,187,772	June 20, 1916	G. E. Ohrn	Ore concentration
1,203,341	Oct. 31, 1916	A. C. Howard	Ore concentration
1,203,372	Oct. 31, 1916	F. J. Lyster	Separation of metallic sulphide ores
1,203,373	Oct. 31, 1916	F. J. Lyster	Ore concentration
1,203,374	Oct. 31, 1916	F. J. Lyster	Ore concentration
1,203,375	Oct. 31, 1916	Lavers, Lowry & Greenway	Ore concentration
1,208,171	Dec. 12, 1916	Lavers, Lowry & Greenway	Concentration of sulphide ores
1,208,334	Dec. 12, 1916	Lavers, Greenway & Lowry	Ore concentration

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 293.

MODEL—KIRBY MIXING TANK "A."

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 294.

MODEL—SEPARATING TANK "B."

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 295.

MODEL—GABBETT MACHINE.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 296.

MODEL—CATTERMOLE UPCASTING
MACHINE.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 297.

MODEL—SLIDE GABBETT MACHINE.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 298.

BAR MIXER.

(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

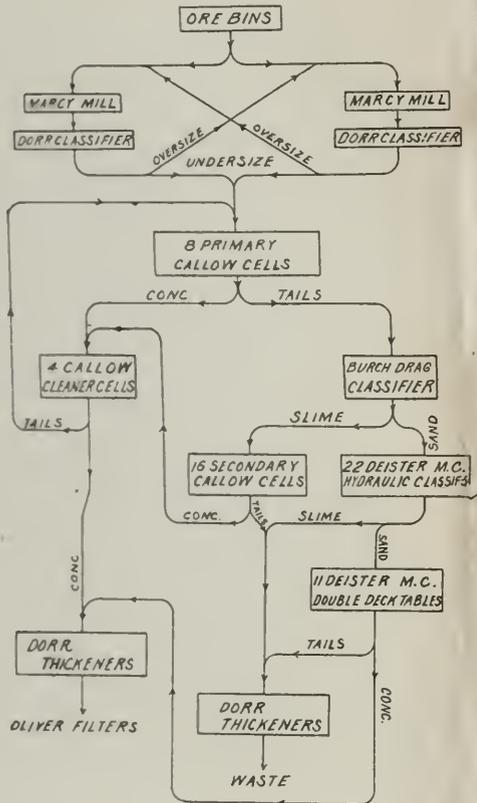
Plaintiffs' Exhibit No. 299.

BATEA.

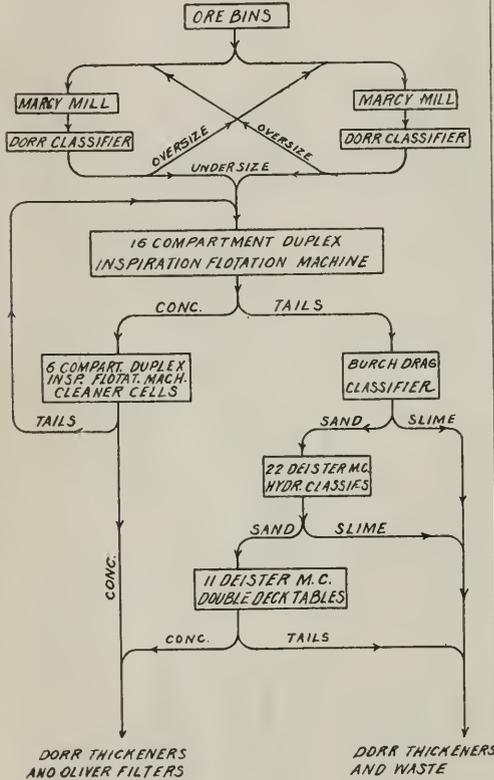
(Physical Exhibit.)

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

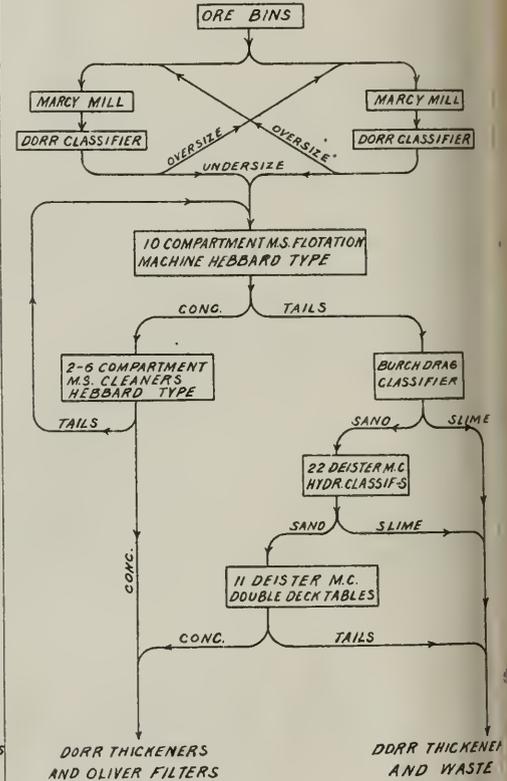
FLOW SHEET OF INSPIRATION MILL
SECTIONS EQUIPPED WITH CALLOW
FLOTATION MACHINES



SECTIONS EQUIPPED WITH
INSPIRATION FLOTATION MACHINES

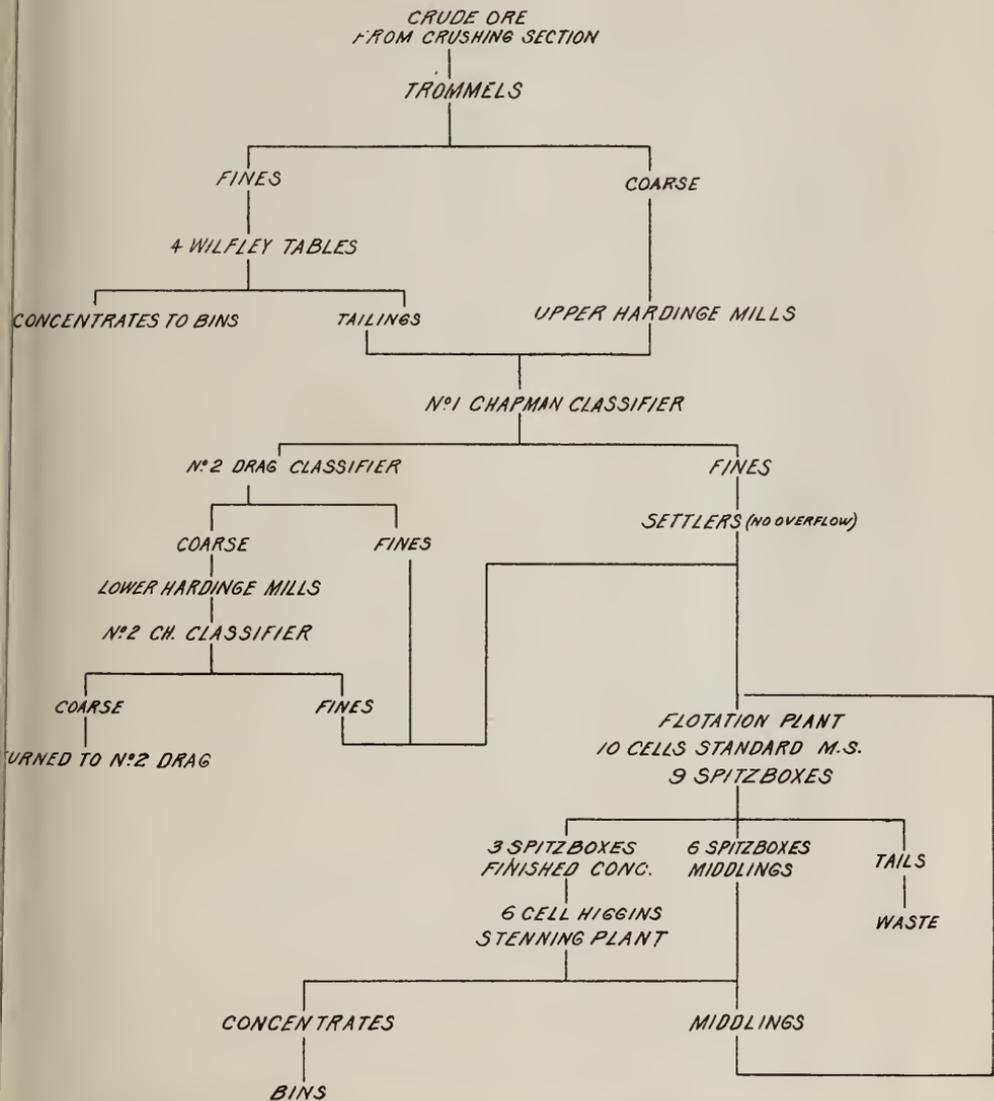


SECTIONS EQUIPPED WITH
MINERALS SEPARATION FLOTATION MACHINES



PLAINTIFF'S EXHIBIT N° 301.

*FLOW SHEET
BRADEN COPPER CO.
OLD MILL, MOLINO, CHILE*



H. W. P.

Defendant's Exhibit No. 302.

Results of an Experiment Performed in Court and Testified to by
B. H. DOSENBACH
 MINIATURE FLOTATION PLANT

Test No. 39.

Operation of Miniature Flotation Plant (Def. Exhibit No. 226) in court
 by B. H. Dosenbach.

Page 1863 (Description)

Ore used60 Pounds
 Butte & Superior ore containing 14.65% zinc.

Water used146 Pounds
 Ordinary tap water at temperature of 16° Centigrade.

Oil used1.266 Pounds
 Butte & Superior Oil Mixture consisting of 70% fuel oil, 18%
 pine oil and 12% kerosene.

AMOUNT OF OIL RELATIVE TO ORE—2.11%

Acid used65 c.c.
 Commercial sulphuric acid having a specific gravity of 59 de-
 grees Be. This amount used as equivalent to 8 pounds
 per ton of ore.

Copper Sulphate Solution used.....78 c.c.
 Anaconda Copper Mining Company's sulphate solution equiv-
 alent to approximately 0.10 pounds metallic copper per
 ton of ore.

Entire Heading % Zinc	Entire Tailing % Zinc	Entire Concentrate % Zn % Ins % Oil	Apparent Recovery % Zinc
14.65	3.27	48.9 11.6 5.09	83.24

SPECIAL SAMPLES

(Cuts made during normal operations)

Concentrate froth:—

	% Zinc	% Insol	% Oil
1st, 2nd and 3rd cuts from recleaner.....	56.2%	4.0%	5.59%
3rd and 4th cuts from recleaner.....	55.6%	4.8%	3.98%

Tailing sample:—

Sample cut for court inspection..... 1.15%

Filed May 18, 1917. **GEO. W. SPROULE, Clerk.**
 By **H. H. WALKER, Deputy.**

Defendant's Exhibit No. 303.

BUTTE & SUPERIOR MINING COMPANY

May 5, 1917.

Mr. J. T. Shimmin,
Mill Superintendent,
Plant.

Dear Sir:—

The enclosed data shows the weights and assays of screen analyses run on samples taken in the plant on April 29th, 1917, of which description was reported to you on May 1st.

The screens reported here are as follows:—

A composite of flotation feed samples, general mill tailings, also a composite, primary tailings, primary middlings, cleaner flotation concentrates, slime feed to the sludge tank, and tube mill discharge. Concentrates from the first, second and third spitz and the first, second and third cleaner tailings were not screened as the rejects were too small to permit.

Yours truly,

(Signed) T. R. FEARLERLY,
Head Sampler.

TRF:JDS

Defendant's Exhibit No. 303

BUTTE & SUPERIOR MINING COMPANY

SCREENING ANALYSES—1:00 to 5:00 P. M.—APRIL 29th, 1917.

Mesh	Weight	% Weight	Accumulative Per cent Weight	Weight Zinc	% Zn.	% Weight Zinc	Accumulative % Weight Zinc
Primary Middling—One Bucket 4th, 5th, 6th & 7th Spitz							
Original	400				10.8		
Plus 48	00.00	00.00					
65	15.00	3.79	3.79	2.69	17.9	6.17	6.17
80	18.00	4.55	8.34	3.20	17.8	7.34	13.51
100	13.00	3.28	11.62	2.21	17.0	5.07	18.58
150	60.00	15.15	26.77	6.60	11.0	15.14	33.72
200	36.00	9.09	35.86	3.24	9.0	7.43	51.15
280	35.00	8.84	44.70	4.41	12.6	10.12	51.27
Minus 280	219.00	55.30	100.00	21.24	9.7	48.73	100.00
Total	396.00	100.00		43.59		100.00	

Cleaner Flotation Concentrates—Finished Product to Thickener Tanks
One Bucket

Original	400				45.2		
Plus 48							
65	13.0	3.28	3.28	5.04	38.8	2.88	2.88
80	8.0	2.02	5.30	3.26	40.7	1.87	4.75
100	22.0	5.56	10.86	9.26	42.1	5.30	10.05
150	50.0	12.63	23.49	22.60	45.2	12.93	22.98
200	29.0	7.32	30.81	13.51	46.6	7.73	30.71
-200	274.0	69.19	100.00	121.10	44.2	69.29	100.00
Total	396.0	100.00		174.77		100.00	

NOTE:—Impossible to put through 280 mesh on account of material being too oily.

Slime Feed to Sludge Tank

Original	400.00				13.6		
Plus 80	10.0	2.51	2.51	1.41	14.1	2.90	2.90
100	15.0	3.77	6.28	1.58	10.5	3.25	6.15
150	65.0	16.33	22.61	6.11	9.4	12.60	18.75
200	40.0	10.05	32.66	4.60	11.5	9.47	28.22
-200	268.0	67.34	100.00	34.84	13.0	71.78	100.00
Total	398.0	100.0		48.54		100.0	

TUBE MILL DISCHARGE

No. 4 Section 1 and No. 1 Section 2

Original	400.00				8.9		
Plus 48	37.0	9.30	9.30	1.67	4.5	4.45	4.45
65	75.0	18.84	28.14	4.13	5.5	11.00	15.45
80	49.0	12.31	40.45	3.38	6.9	9.01	24.46
100	62.0	15.58	56.03	5.08	8.2	13.54	38.00
150	78.0	19.60	75.63	9.13	11.7	24.33	62.33
200	23.0	5.78	81.41	3.11	13.5	8.28	70.61
-200	74.0	18.59	100.00	11.03	14.9	29.39	100.00
Total	398.0	100.00		37.53		100.00	

Defendant's Exhibit No. 303

BUTTE & SUPERIOR MINING COMPANY

SCREENING ANALYSES—1:00 to 5:00 P. M.—APRIL 29th, 1917.

Mesh	Weight	% Weight	Accumulative Per cent Weight	Weight Zinc	Zn. %	% Weight Zinc	Accumula- tive % Weight Zinc
General Mill Tailings Composite—Three Buckets							
Original	400.00				1.57		
Plus 48	10.00	2.53	2.53	.40	3.95	5.71	5.71
65	40.00	10.10	12.63	1.30	3.25	18.57	24.28
80	32.00	8.08	20.71	.69	2.15	9.86	34.14
100	35.00	8.84	29.55	.49	1.40	7.00	41.14
150	58.00	14.65	44.20	.65	1.12	9.29	50.43
200	60.00	15.15	59.35	.64	1.07	9.14	59.57
280	20.00	5.05	64.40	.15	.77	2.14	61.71
- 280	141.00	35.60	100.00	2.68	1.90	38.29	100.00
Total	396.00	100.00		7.00		100.00	

Primary Tailings—One Bucket

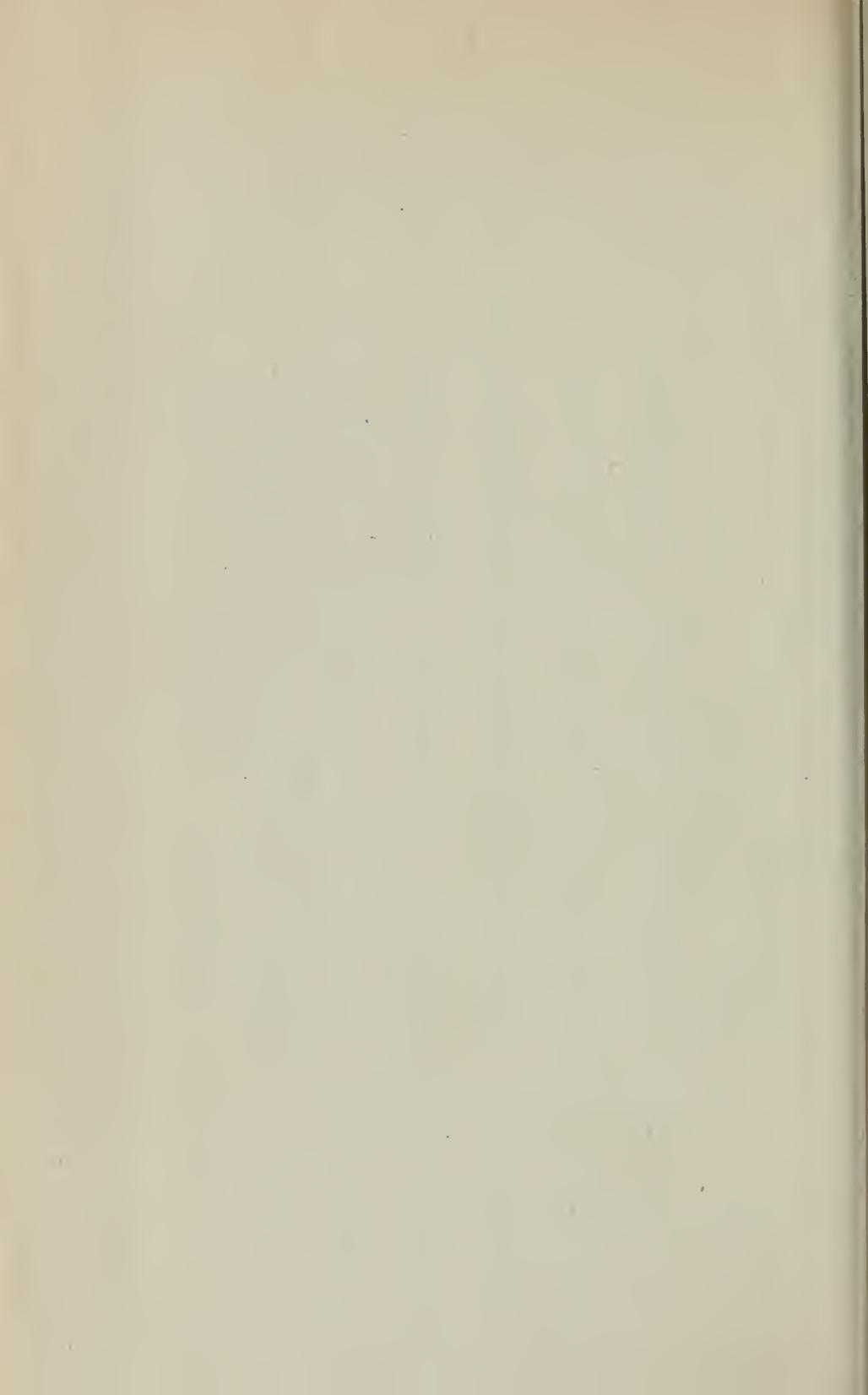
Original	400.00				1.16		
Plus 48	15.00	3.77	3.77	.56	3.70	10.31	10.31
65	58.00	14.61	18.38	1.74	3.00	32.04	42.35
80	19.00	4.79	23.17	.33	1.75	6.08	48.43
100	40.00	10.07	33.24	.50	1.25	9.21	57.64
150	78.00	19.65	52.89	.68	.87	12.52	70.16
200	42.00	10.58	63.47	.26	.62	4.70	74.95
280	35.00	8.82	72.29	.20	.57	3.69	78.64
- 280	110.00	27.71	100.00	1.16	1.04	21.36	100.00
Total	397.00	100.00		5.43		100.00	

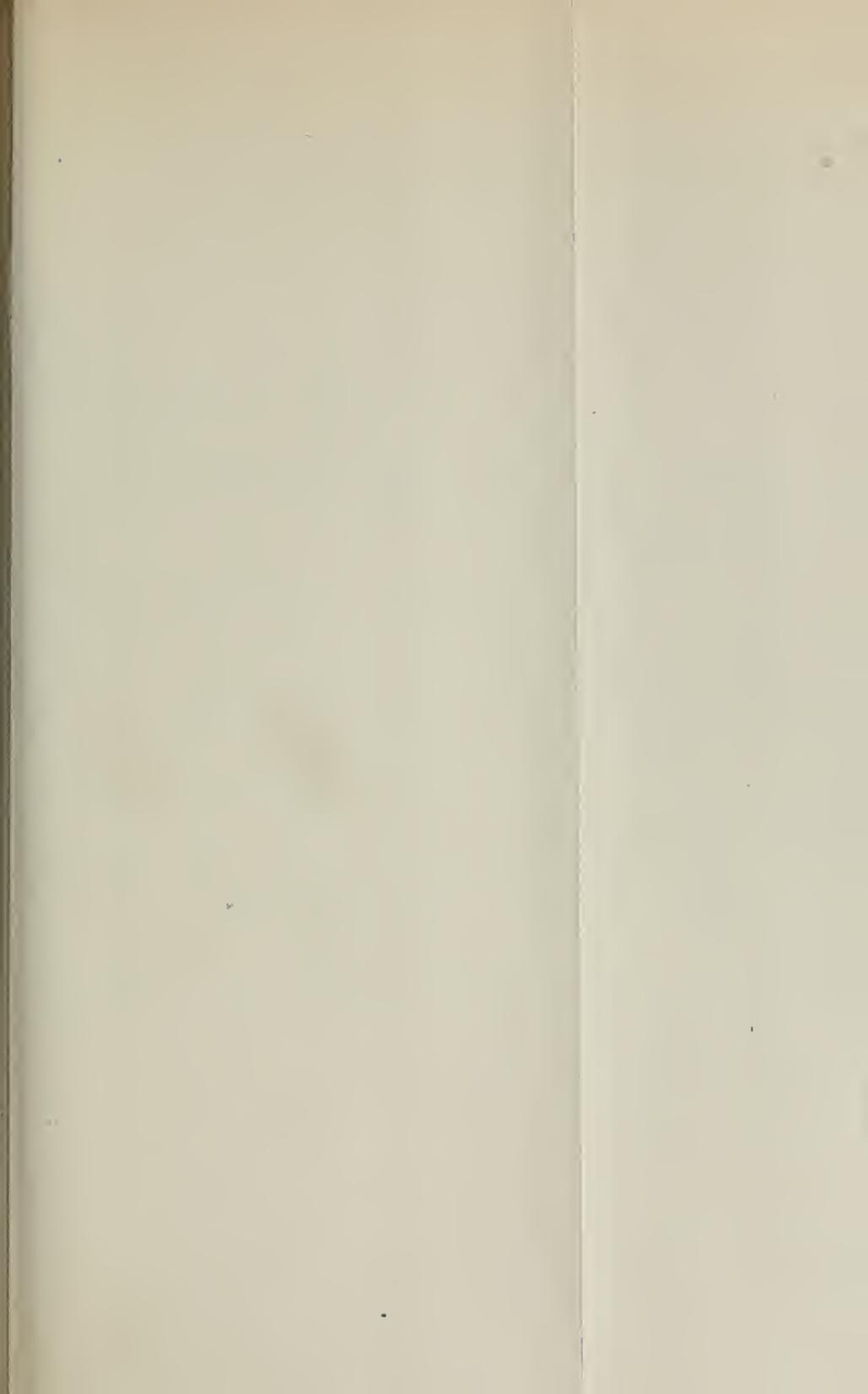
Flotation Feed Composite—Six Buckets

Original	400.00				12.6		
Plus 48	5.00	1.27	1.27	.43	8.5	.85	.85
65	37.00	9.37	10.64	4.74	12.8	9.36	10.21
80	25.00	6.33	16.97	3.30	13.2	6.51	16.72
100	30.00	7.59	24.56	4.32	14.4	8.53	25.25
150	58.00	14.68	39.24	7.42	12.8	14.65	39.90
200	32.00	8.10	47.34	3.84	12.0	7.58	47.48
280	39.00	9.87	57.21	4.80	12.3	9.48	56.96
- 280	169.00	42.79	100.00	21.80	12.9	43.04	100.00
Total	395.00	100.00		50.65		100.00	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.





Defendant

RESULTS OF EXPERIMENTS PERFORMED BY
B. H. H.

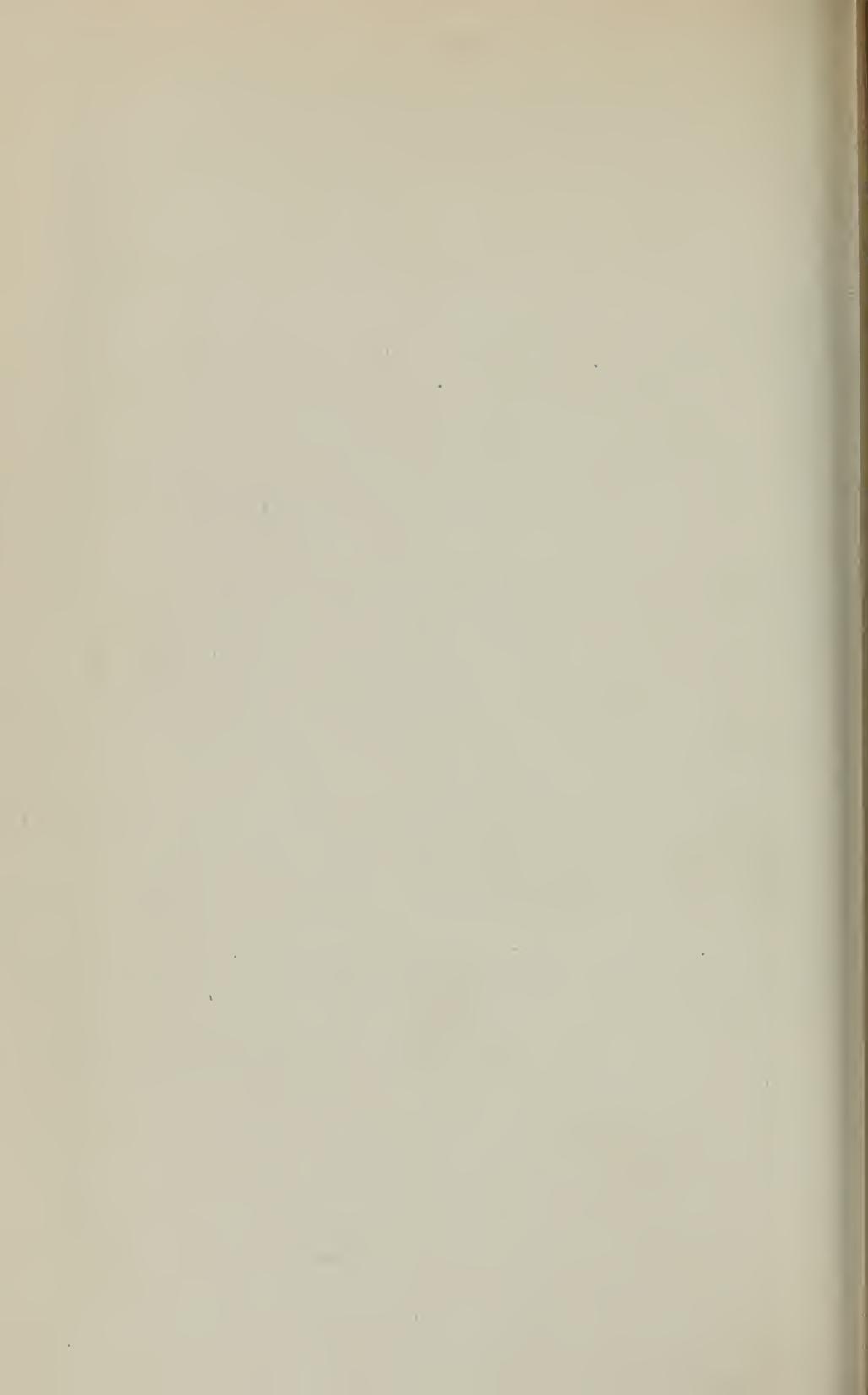
Operation	Refer. Record Page No.	Apparatus	Kind	ORE USED					Kind
				Amt. Grams	% Zn.	% Cu.	% Fe.	% Insol.	
Person Test No. 30	Page 1211 " 1212	After Description in Fryer Hill Publication	Cu.	300		8.14	4.90	78.0	Petroleum Distillate
Person Test No. 31	" 1223	Cattaract	Cu.	200		6.14	6.65	74.5	Texas Distillate
by Test No. 32	" 1224 " 1228	Sq. Glass agitator	Cu.	300		5.87	6.76	75.4	Petroleum Distillate
ate & erior	" 1281	Sq. Glass agitator	Zn.	300	17.4			64.0	Oil Mixture
ernate ermole & in suit Test No. 33	" 1262 " 1263	Cone Gabbett Mach.	Zn.	300	14.7	0.16	1.94	67.0	Oleic Acid
ate & Super- Test No. 36	1283	"	Zn.	300	14.7			67.0	Pine Tar

304.

COURT AND TESTIFIED TO BY

Oil re	ACID		WATER		ASSAYS				
	Kind	Amount c.c. Grams	Amt. c.c.	Temp. Deg. C.	% Zinc	% Cu.	% Ins.	% Fe.	% Oil
%	Sulphuric	2.4 4.41	1250	42°	Mineral Froth	226.60	12.0	25.92	4.85
%	"	1.6 2.94	1250	30°	Mineral Froth	23.67	20.8	22.5	6.65
%	"	2.0 3.68	1500	25°	Mineral Froth	23.94	21.0	23.5	9.62
5	Copper Sul.	.51 1.102							
	Sulphuric	.67 1.23	1500	30°	Mineral Froth	47.10	16.0		0.64
5	Sulphuric	1.0 1.84	1500	35°	Mineral Froth				
					1st	42.60	15.40		
					2nd	40.70	16.00		
					Cattermole Granules	32.70	35.60		2.03
					Upcast Overflow	3.90	87.80		1.12
62%	Sulphuric	.05 .92	1250	35°	Mineral Froth	33.90	31.20		3.39

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Defendant's Exhibit No. 305.

RESULTS OF AN EXPERIMENT PERFORMED IN COURT AND TESTIFIED TO BY B. H. DOSENBACH

Test No. 34.

Operation performed in Janney Flotation Machine (Def. Exhibit
No.) Page 1273.

Ore used 400 Grams
Butte & Superior ore containing 15.3% zinc.

Water used 1900 c.c.
Ordinary tap water at a temperature of 30° Centigrade

Oil used $1\frac{1}{2}\%$ relative to ore
Butte & Superior oil mixture, consisting of 70% fuel oil, 18%
pine oil and 12% kerosene.
6 grams.

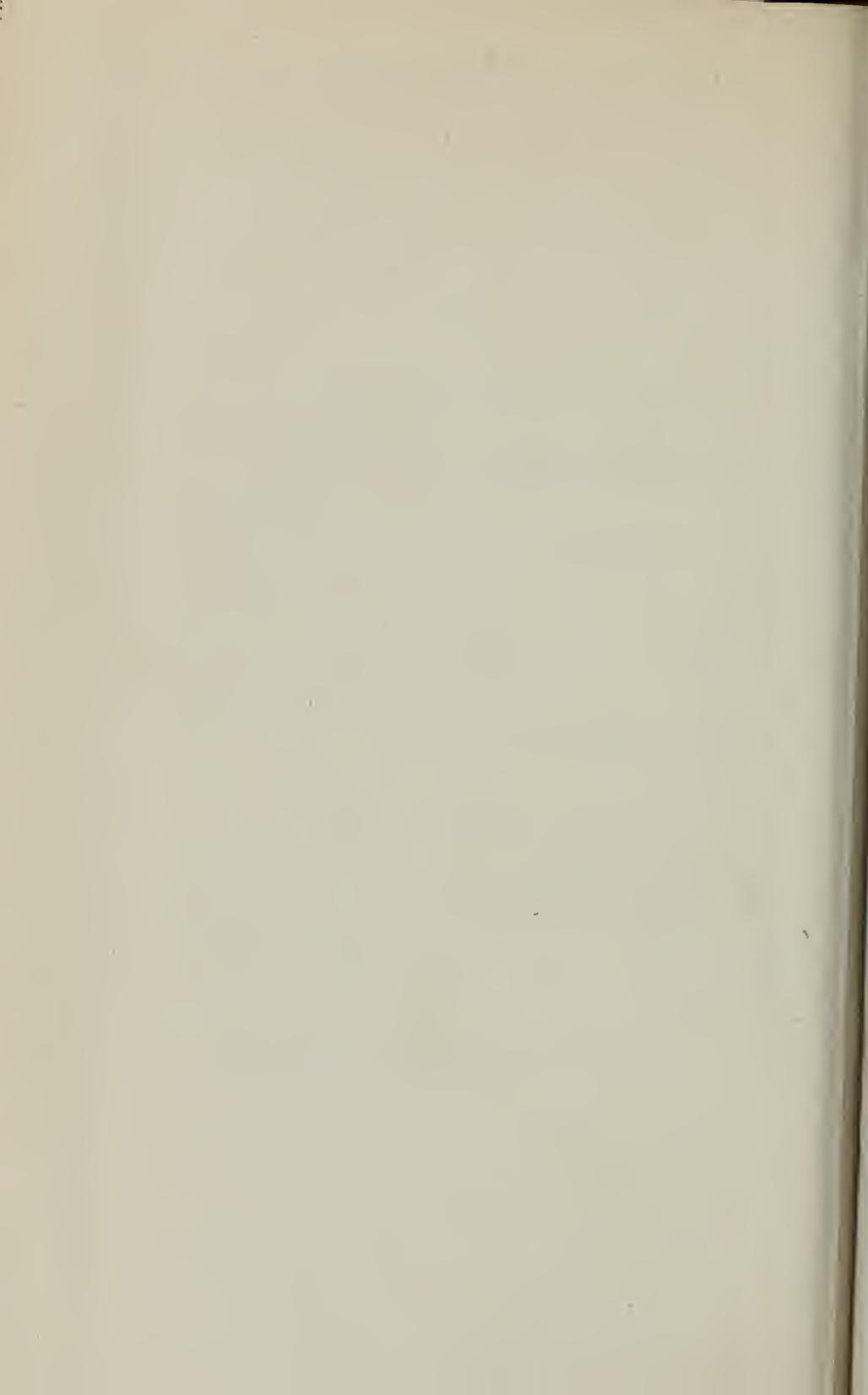
Acid used 0.9 c.c.
Concentrated sulphuric acid (Specific Gravity 1.84)

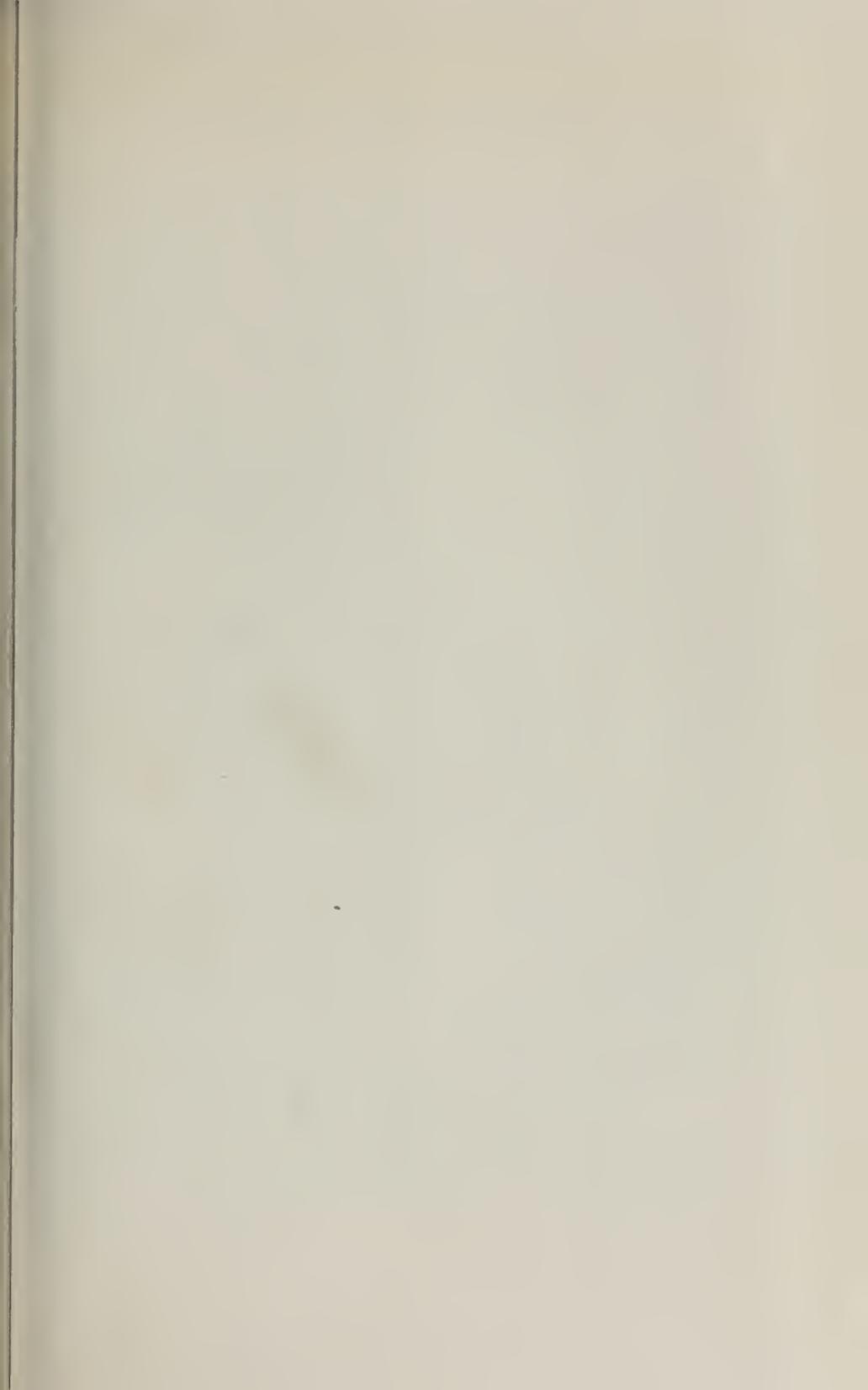
Copper Sulphate Solution 1.0 c.c.
Anaconda Copper Mining Company's copper sulphate solu-
tion; equivalent to 0.10 pounds per ton of ore.

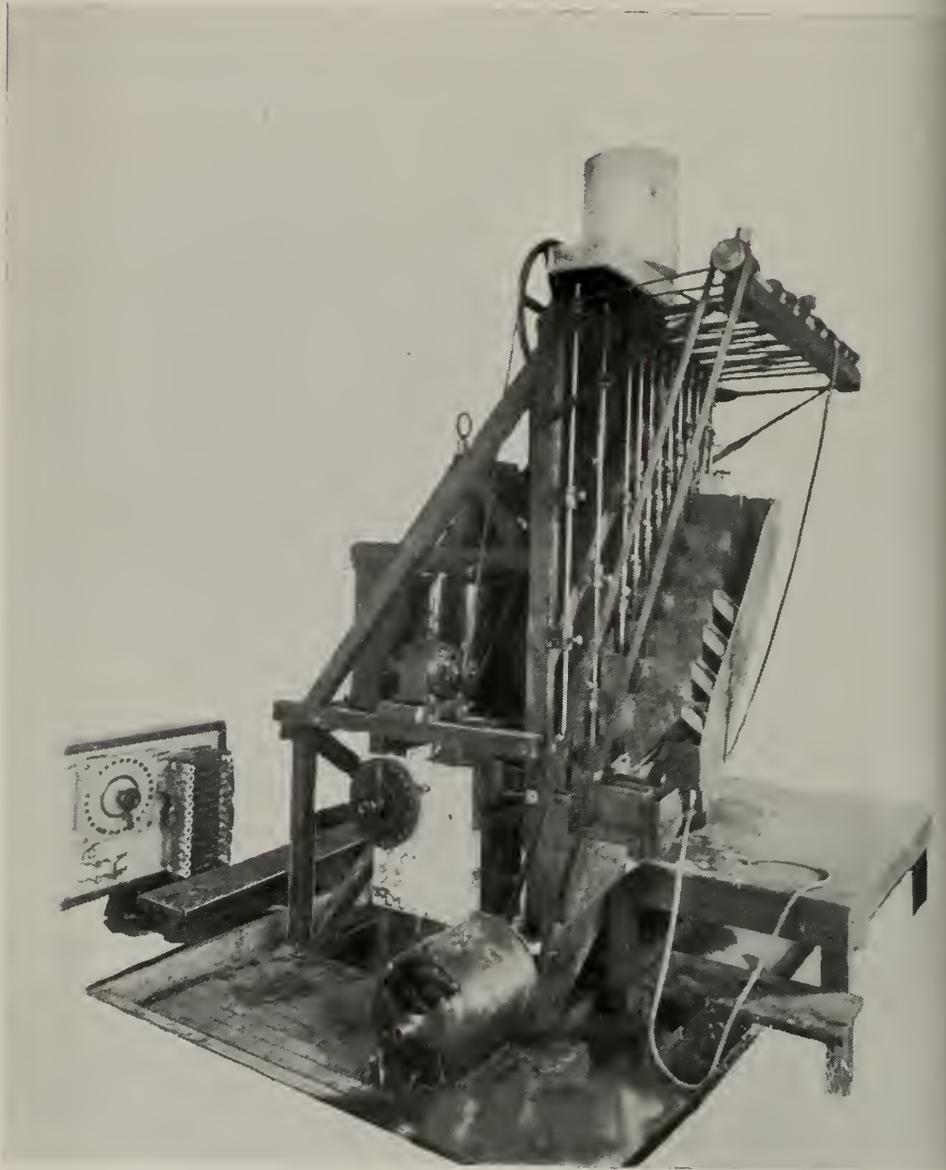
Heading % Zinc	Tailing % Zinc	Concentrate		Middling	Apparent Recovery
		% Zn.	% Oil	% Zinc	% Zinc
15.3	0.44	44.3	2.12	32.5	98.09

Filed May 18, 1917. GEO. W. SPROULE, Clerk.

By H. H. WALKER, Deputy.





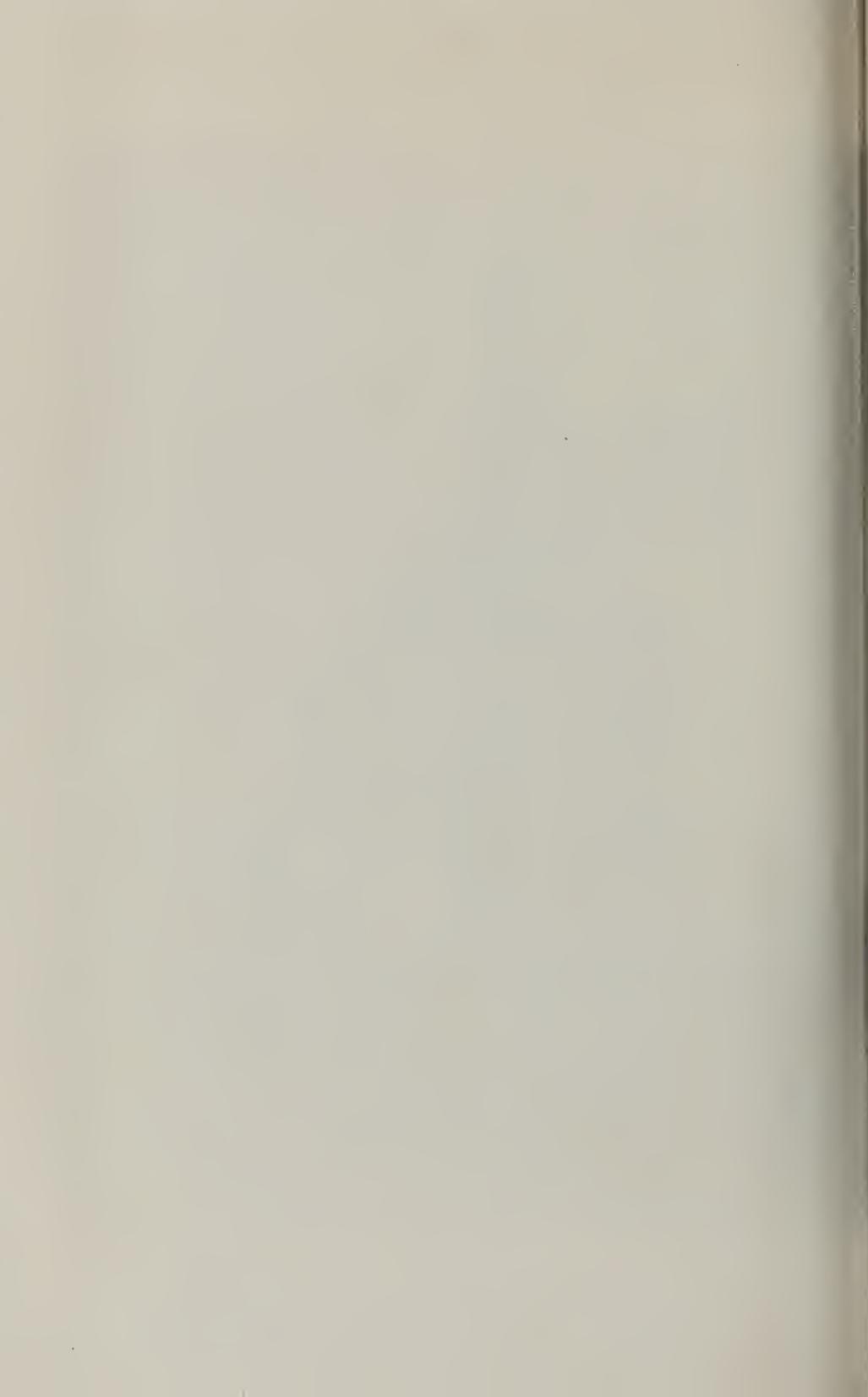
Defendant's Exhibit No. 306.

Filed May 18, 1917. GEO. W. SPROULE.
By H. H. WALKER.

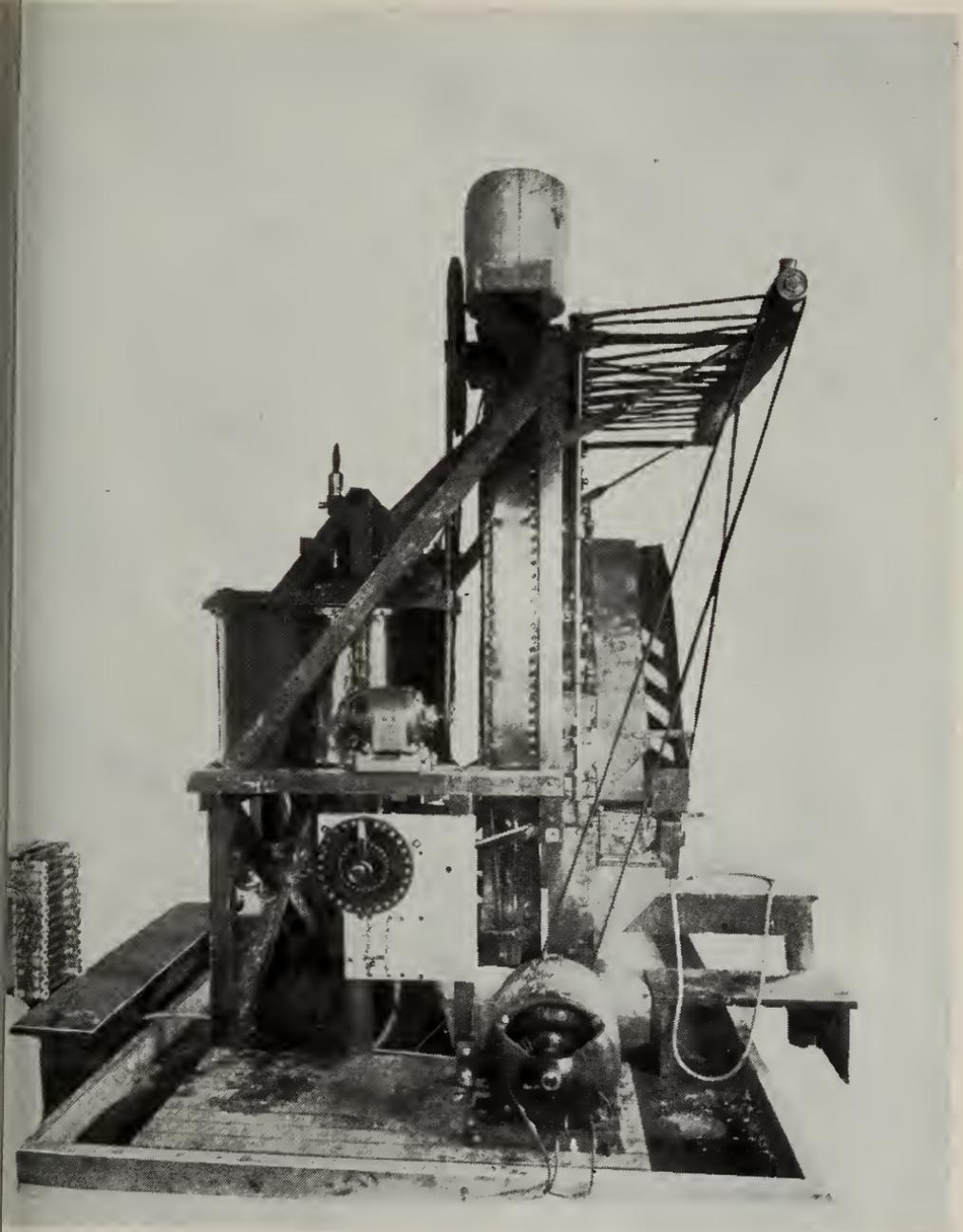
Defendant's Exhibit No. 307.



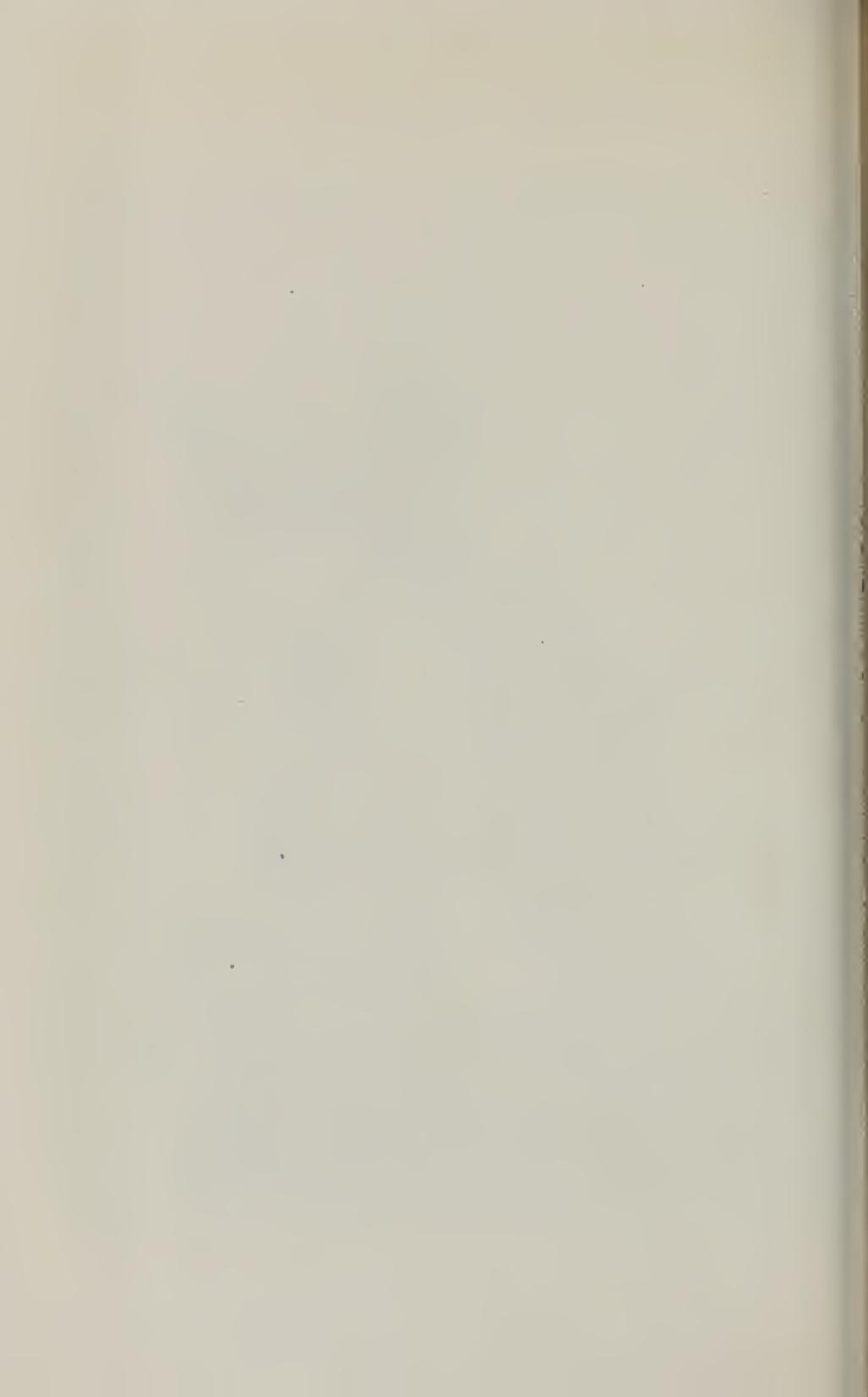
Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Defendant's Exhibit No. 308.



Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.



Plaintiffs' Exhibit No. 309.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed
March, 1917

Mar.	COPPER SAND			COPPER SLIME			ZINC ORE		
	Sludge	Creosote	H ₂ SO ₄	Sludge	Creosote	H ₂ SO ₄	Sludge	Creosote	H ₂ SO ₄
1	3.5	.34	8.0	4.3	2.90	19.5	1.0	1.7	29.6
2	3.5	.36	7.7	3.9	2.14	14.1	1.0	1.9	27.6
3	3.6	.36	7.7	3.4	2.51	14.3	1.1	1.8	29.0
4	3.7	.34	7.7	4.2	2.85	19.2	1.1	2.3	28.6
5	3.7	.38	7.9	3.6	2.59	16.2	0.9	1.8	26.5
6	3.7	.34	7.6	4.0	2.71	18.1	0.9	1.7	19.0
7	3.7	.32	7.8	4.0	2.72	17.2	0.8	1.9	26.7
8	3.6	.33	7.9	3.5	2.34	15.0	0.8	1.6	20.7
9	3.7	.31	7.7	3.5	2.38	15.1	0.9	1.6	21.1
10	3.7	.38	7.8	3.4	2.33	15.0	1.5	2.0	25.0
11	3.7	.27	7.9	3.7	2.45	17.3	1.2	1.4	21.4
12	3.7	.32	7.9	3.4	2.20	13.6	0.9	1.4	24.6
13	3.6	.34	7.9	3.6	2.48	15.6	1.0	1.6	33.6
14	3.4	.18	7.9	3.8	2.66	16.8	0.8	1.1	19.0
15	3.5	.22	8.1	4.4	2.69	18.6	0.9	1.6	22.0
16	3.5	None	8.0	3.4	1.92	15.6	0.8	1.4	25.2
17	3.4	.17	8.1	3.9	2.22	16.4	0.8	1.4	23.8
18	3.5	.15	8.1	3.7	2.25	16.4	0.9	1.8	21.3
19	3.4	None	7.9	3.6	2.18	16.2	0.8	1.3	24.2
20	3.4	.41	7.8	3.8	2.32	16.4	1.6	1.5	24.6
21	3.3	None	7.8	3.4	2.16	14.9	1.0	1.9	21.9
22	3.2	.18	8.0	3.3	1.99	14.3	1.0	1.8	29.9
23	3.2	.24	8.1	3.8	2.26	16.8	0.8	1.6	28.4
24	3.3	.20	8.6	3.9	2.25	17.4	0.8	2.0	24.0
25	3.2	.50	8.0	3.6	2.01	14.7	Plant Down		
26	3.1	.30	8.0	3.9	2.31	16.9	1.0	2.4	27.4
27	3.2	.50	8.5	3.7	2.37	17.2	0.9	1.9	33.4
28	3.1	.45	8.2	3.2	1.78	14.1	0.8	1.6	30.3
29	3.1	.40	8.1	3.7	2.34	17.5	1.0	1.5	29.6
30	3.1	.48	8.1	2.9	1.68	13.6	1.2	1.8	29.0
31	3.1	.24	8.2	3.3	1.88	15.1	1.7	1.5	33.8

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 310.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed

February, 1917

Feb.	COPPER SAND			COPPER SLIME			ZINC ORE		
	Sludge	Creosote	H ₂ SO ₄	Sludge	Creosote	H ₂ SO ₄	Sludge	Creosote	H ₂ SO ₄
1	3.5	.57	7.1	3.0	1.94	12.8	1.4	2.5	31.9
2	3.5	.41	7.0	3.0	1.85	12.0	1.0	2.0	19.3
3	3.6	.38	7.1	2.9	1.70	12.0	0.8	1.5	24.6
4	3.3	.32	7.0	3.2	2.19	11.3	1.1	1.5	28.0
5	3.3	.38	7.0	2.8	1.59	11.8	1.2	1.8	23.9
6	3.1	.41	7.2	3.6	2.06	13.5		Missing	
7	2.8	.39	7.3	4.9	2.10	14.8	0.9	1.6	31.9
8	3.3	.38	7.6	4.1	2.00	16.4	0.8	1.5	30.8
9	3.4	.35	7.4	5.3	2.50	21.7	1.0	1.9	30.5
10	3.3	.29	7.3	5.0	2.20	18.9	0.6	1.5	17.5
11	3.4	.24	7.4	3.9	1.65	14.7	0.8	1.6	20.7
12	3.4	.36	7.6	5.4	2.08	18.1	1.0	2.0	27.4
13	3.4	.34	7.6	5.4	1.80	18.7	0.9	1.8	24.0
14	3.4	.33	7.6	5.7	2.09	21.7	0.9	1.8	19.7
15	3.4	.26	7.5	5.8	1.85	21.4	0.8	1.9	17.0
16	3.6	.32	7.7	4.6	2.12	19.9	0.8	1.8	23.1
17	3.5	.31	7.8	5.7	3.10	24.4	1.1	2.2	26.0
18	3.6	.36	8.1	4.1	2.43	18.9	1.2	1.9	26.6
19	3.6	.32	7.8	3.9	2.54	19.2	0.8	2.0	24.7
20	3.8	.39	7.6	3.8	2.23	16.1	0.9	1.9	24.0
21	3.7	.37	7.9	3.8	2.20	17.2	1.0	1.9	18.5
22	3.7	.39	7.9	4.1	2.53	18.9	0.8	1.5	21.5
23	3.7	.24	7.7	3.9	2.41	17.4	0.8	1.8	26.3
24	3.6	.31	7.8	3.8	2.35	17.0	1.3	2.4	37.4
25	3.6	.45	7.8	3.9	2.42	17.6	1.5	2.0	34.6
26	3.6	.39	7.7	4.4	2.44	17.7	2.0	3.6	50.4
27	3.6	.28	7.8	4.1	2.28	21.1	1.0	2.2	30.6
28	3.6	.25	7.7	3.9	2.38	16.1	0.9	2.1	25.0

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 311.

ANACONDA COPPER MINING COMPANY

DEPARTMENT OF CONCENTRATION

Reagent Consumption—lbs. per Ton of Flotation Feed

January, 1917

n.	COPPER SAND			COPPER SLIME			ZINC ORE		
	Sludge	Creosote	H ₂ SO ₄	Sludge	Creosote	H ₂ SO ₄	Sludge	Creosote	H ₂ SO ₄
2	2.6	.22	6.8	2.9	1.75	13.2	0.5	2.6	20.7
3	3.3	.20	6.9	2.9	1.70	13.7	1.1	3.0	22.2
4	3.1	.22	6.8	3.1	1.90	14.3	0.7	2.3	19.0
5	3.1	.24	6.9	3.7	2.20	15.3	0.8	2.6	19.0
6	3.2	.26	7.2	3.2	1.90	13.7	0.8	2.7	20.0
7	3.2	.24	7.4	3.6	2.10	15.6	0.9	2.8	19.9
8	3.1	.27	7.2	3.5	2.20	15.7	0.9	2.5	19.1
9	3.1	.25	7.1	3.3	1.95	14.3	0.8	2.5	20.4
0	3.1	.23	7.1	3.4	1.85	14.6	0.8	3.1	24.0
1	3.3	.32	7.3	3.2	1.90	13.2	0.9	2.5	23.0
2	3.2	.26	7.0	3.5	2.10	14.7	0.8	3.1	27.8
3	3.2	.27	7.0	3.5	2.15	15.4	0.8	3.0	30.8
4	3.2	.33	6.9	3.7	2.30	16.0	0.9	2.5	19.4
5	3.4	.24	7.3	3.6	2.35	15.8	0.9	2.9	32.4
6	3.4	.31	7.2	3.8	2.35	15.0	0.9	3.1	25.5
7	3.2	.17	7.0	3.5	2.10	14.9	0.8	2.7	17.7
8	3.1	.23	7.0	3.4	2.15	15.0	0.8	2.9	21.5
9	3.4	.32	7.1	3.7	2.25	14.7	0.4	2.2	22.1
0	3.3	.27	7.1	3.7	2.30	14.9	0.6	2.3	23.9
1	3.4	.26	7.3	3.7	2.25	15.1	0.3	2.5	19.8
2	3.4	.30	7.5	3.6	2.20	14.8	0.9	3.0	28.4
3	3.4	.30	7.2	3.5	2.50	14.2	0.9	2.5	25.5
4	3.4	.41	7.1	3.4	2.20	13.6	0.7	2.6	22.7
5	3.3	.43	7.1	3.4	1.90	13.0	0.8	1.9	19.1
6	3.4	.36	7.1	3.3	2.05	12.9	0.7	2.1	26.4
7	3.4	.37	7.4	3.4	2.15	13.2	0.9	2.8	29.5
8	3.0	.38	7.3	3.8	2.25	14.2	0.8	2.4	28.9
9	3.4	.39	7.2	3.5	2.40	13.5	0.7	2.3	28.1
0	3.4	.50	7.3	3.8	2.05	13.0	1.0	2.2	32.0
1	3.0	.32	7.6	4.0	2.20	14.8	1.2	2.4	26.9
	3.4	.49	7.4	3.3	1.90	13.0	1.1	2.1	25.0

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy

Plaintiffs' Exhibit No. 312.

ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION
Current Mill Slime—Per Cent Cu.

	JANUARY	FEBRUARY	MARCH
1	2.63	2.44	2.51
2	2.63	2.71	2.80
3	2.47	2.78	2.57
4	2.75	2.65	2.66
5	2.67	2.60	2.39
6	3.06	2.81	2.60
7	2.31	2.61	2.30
8	2.67	2.40	2.47
9	2.69	2.77	2.46
10	2.50	2.83	2.73
11	2.60	2.65	2.81
12	2.81	2.68	2.45
13	2.47	2.65	2.93
14	2.65	2.72	2.81
15	2.54	2.61	2.41
16	2.82	2.96	2.33
17	2.66	2.40	2.64
18	2.73	2.44	2.51
19	2.53	2.42	3.07
20	2.66	2.77	2.76
21	2.82	2.25	2.72
22	2.73	2.70	2.84
23	2.57	2.52	2.54
24	2.76	2.71	2.38
25	2.60	2.63	3.15
26	2.82	2.77	2.62
27	3.10	2.37	2.49
28	2.54	2.85	2.74
29	2.70		2.69
30	2.84		2.83
31	2.67		2.83

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 313.

**ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION**

Reagent Consumption and Sulphide Content of Ore—Jan., 1917

	REAGENTS USED LBS. PER TON									
	% Cu.	% Pb.	% Zn.	% Fe.	% S	% Sulphide	Sludge	Creosote	Total Oil	H ₂ SO ₄
and	1.0			4.0	5.0	10.3 [‡]	3.4	0.1	3.5	6.8
lime	2.6			4.2	6.0	12.8	3.6	1.9	5.5	13.8
.....	0.7	3.0	13.2	7.0	14.7	38.6	0.7	2.7 [‡]	3.4	22.7

of 60% Creosote from Cleveland Cliffs Iron Co., Marquette, Mich., and 40% Tar special from Georgia Pine Turpentine Co.

mill operations we treat $0.578 \times 2000 = 1156$ tons of Sand and approximately 120 lime in each section. Therefore, the true total sulphide figure for the "sand" feed in the mill should be $\frac{1156 \times 10 + 120 \times 13.4}{1276} = 10.3$. This accounts for dis-

between figure shown and addition which would be 10.0%. The total sulphide lime returned to the mill for treatment is 13.4%.

Filed May 18, 1917. By H. H. WALKER, Deputy.
GEO. W. SPROULE, Clerk.

Plaintiffs' Exhibit No. 314.**ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION****Reagents Consumption and Sulphide Content of Ore—Feb. 1917**

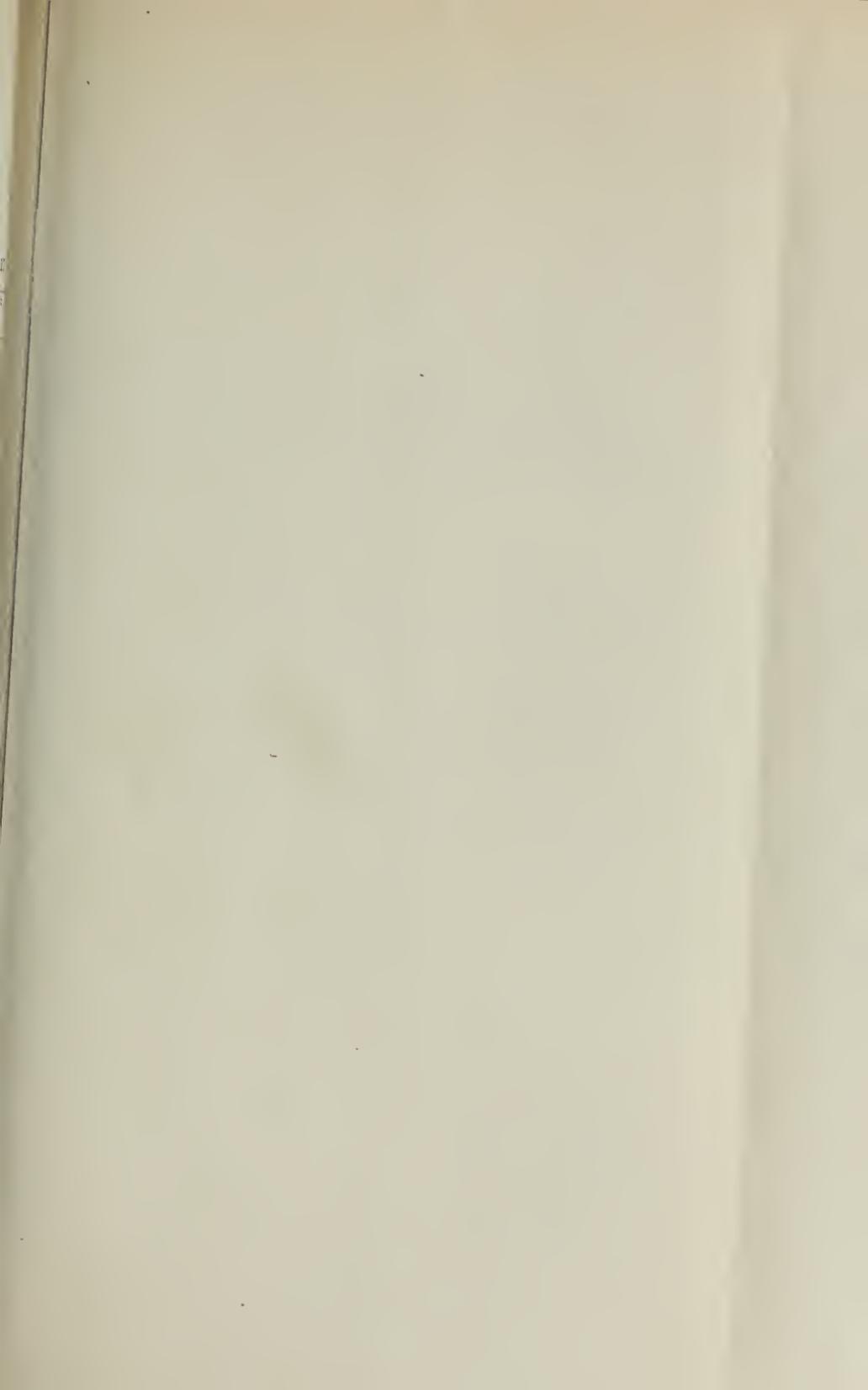
PRODUCT—	% Cu.	% Pb.	% Zn.	% Fe.	% S	% Sulphide	REAGENTS USE LBS. PER TON		
							Sludge	Creosote	Total Oil
(Mixed)									
Copper Sand	1.15			5.2	4.8	11.15	4.01	.13	4.14
Copper Slime	2.50			4.1	5.4	12.00	4.85	2.12	6.97
Zinc Ore .....	.69	2.8	12.35	7.5	12.6	35.94	1.00	2.40	3.40

Filed May 18, 1917. GEO. W. SPROULE, Clk
By H. H. WALKER, Dep

Plaintiffs' Exhibit No. 315.**ANACONDA COPPER MINING COMPANY
DEPARTMENT OF CONCENTRATION****Reagent Consumption and Sulphide Content of Ore—Mar. 1917**

PRODUCT—	% Cu.	% Pb.	% Zn.	% Fe.	% S	% Sulphide	REAGENTS USE LBS. PER TON		
							Sludge	Creosote	Total Oil
(Mixed)									
Copper Sand	1.24			5.5	4.9	11.64	2.94	.05	2.99
Copper Slime	2.40			4.3	5.5	12.20	3.15	2.11	5.26
Zinc Ore .....	.54	3.0	13.48	6.45	13.6	37.07	.80	1.44	2.24

Filed May 18, 1917. GEO. W. SPROULE, C
By H. H. WALKER, D



MINERALS SEPARATION COMPANY, LIMITED
 Referring to Defendant's Exhibit No. 29 Chino Copper Comp

PERIOD	HEADING TO FLOTATION FLOTATION CONCENTRATES				RECOVERY % CU.					
	Tons	Assay % Cu.	Contents Lbs. of Cu.	Ratio of Concentration	Tons	Assay % Cu.	Contents Lbs. of Cu.	Calculated by Contents	Given in Exh. 29	Tons by
1916 3rd Quarter	26804	7.01	3757921	3.94	6804	27.10	3687768	98.13	96.717	200
1916 October	9794	7.77	1521988	3.40	2884	26.03	1501410	98.65	98.17	69
1916 Nov. 18, 19, 20	561	10.24	114893	2.95	190	29.78	113164	98.49	98.423	3

Recompiled May 13th, 1917, by F. R. Wicks

N. 316.

VS. TUTTE & SUPERIOR MINING COMPANY

of Vanner Concentrates. Mr. Wick's Evidence Q 25 and Q 26.

Day	Cu.	LOSS OF CU. IN TAILINGS PER LB. CU. IN HEADINGS		COST OF SMELTING CONCTS.			COST OF CONCENTRATION			OIL	OTHER REAGENTS
		Lbs. in Tailings per lbs. in Heads	Val. if One lb. Cu. in Conc. be Worth 20c Net to the Mill.	Smelting Chg. & Frt. per Ton of Conc.	Total	Per Lb. Cu. in Heading	Cost of Oil per Lb. Cu. in Heading	Cost of Reagents per Lb. Cu. in Heading	Total Oil, Reagents & Loss in Tails (per Lb. Cu. in Heads)	Lbs. per Ton of Heading	Lbs. per Ton of Heading
5	.306	0.0186	\$0.00372	\$6.00	\$40824	\$0.01086	\$0.0153	\$0.00137	0.01595	8.76	4.57
9	.200	0.0135	0.00270	6.00	17304	0.01136	0.0146	0.00147	0.01553	10.26	4.77
3	.244	0.01504	0.00301	6.00	1140	0.00992	0.00446	0.00136	0.01429	23.70	6.34

-180)

(Signed) F. R. Wicks

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 317.

B. & S. MINIATURE PLANT TEST.
MINERALS SEPARATION

PRODUCTS	Assays % Zn.	Recovery %
Concentrates	49.46	81.38
Tailings	3.51	
Residue	14.39	

Filed May 18, 1917. GEO. W. SPROULE, Clerk.
By H. H. WALKER, Deputy.

Plaintiffs' Exhibit No. 318.**ASSAYS OF HIGGINS' TESTS.
MINERALS SEPARATION**

		Assay % Cu.	% Insols.
Mr. Higgins	Crude	4.64	.....
Test Illustration of Bumping Table on Batea	Concs.	14.12	17.65
—35 Mesh from Feed to Wilfley's Anaconda Plant COPPER, May 11th	Tails	1.27	.....
Mr. Higgins	Crude	4.64	.....
Everson Test	Concs.	12.08	21.03
—35 Mesh from Feed to Wilfley's Anaconda Plant COPPER, May 11th	Tails	2.70	.....
Mr. Higgins	Crude	0.51	.....
Kirby Test	Concs.	1.26	36.01
Rossland Ore COPPER, May 11th	Tails	0.51	.....
Mr. Higgins	Crude	20.68	.....
Cattermole	Concs.	56.63	2.53
Test BLACK ROCK RECEIVED 1912-13 ZINC, May 11th	Tails	1.99	.....
Mr. Higgins	Crude	20.14	.....
Test on Solution Patent	Concs.	44.86	7.25
B. H. T. ZINC May 12th	Tails	4.19	.....

Filed May 18, 1917. GEO. W. SPROULE, Cl
By H. H. WALKER, De

The foregoing statement of the evidence and proceedings in the cause named in the caption hereof is in due time presented to the judge of this court and is approved by the judge aforesaid as true, complete and properly prepared in accordance with the stipulations made and entered into between the parties hereto.

Dated this.....3.....day of ~~September~~ ^{October}, 1917.

GEO. M. BOURQUIN, Judge.

Statement of evidence and proceedings filed ~~September~~ ^{October} 10, 1917.

GEO. W. SPROULE, Clerk,
By HARRY H. WALKER,
Deputy Clerk.

UNITED STATES OF AMERICA,
DISTRICT OF MONTANA,
COUNTY OF SILVER BOW,—ss.

I, GEORGE W. SPROULE, Clerk of the District Court of the United States, for the District of Montana, do certify and return to the honorable, the United States Circuit Court of Appeals, for the Ninth Circuit, that the foregoing record, consisting of 5793 pages, numbered from 1 to 230 and 1 to 5563, is a true and correct transcript of the pleadings, findings and conclusions of the court, decree, opinion of the court, statement of evidence and proceedings, stipulations and records therein, certificate of approval and other proceedings had in said cause and of the whole thereof, as appears from the original records filed in said court in my possession, the same being made up in accordance with the Praeceptum heretofore delivered to me. And I do further certify and return that I have annexed to said transcript and included within said paging the original citation. I further certify that all exhibits have been and are herewith certified by me to be produced in court in accordance with the order of court. I further certify that the cost of the transcript of the record amounts to the sum of \$2177.⁰⁰ and that the same has been paid by the appellant.

IN WITNESS WHEREOF, I have hereunto set

by hand and affixed the seal of said court, at Butte,
in the District of Montana, this ^{5th} day of November,
in the year of our Lord nineteen hundred and seventeen,
and of the Independence of the United States, the one
hundred and forty ~~first~~ ^{second}

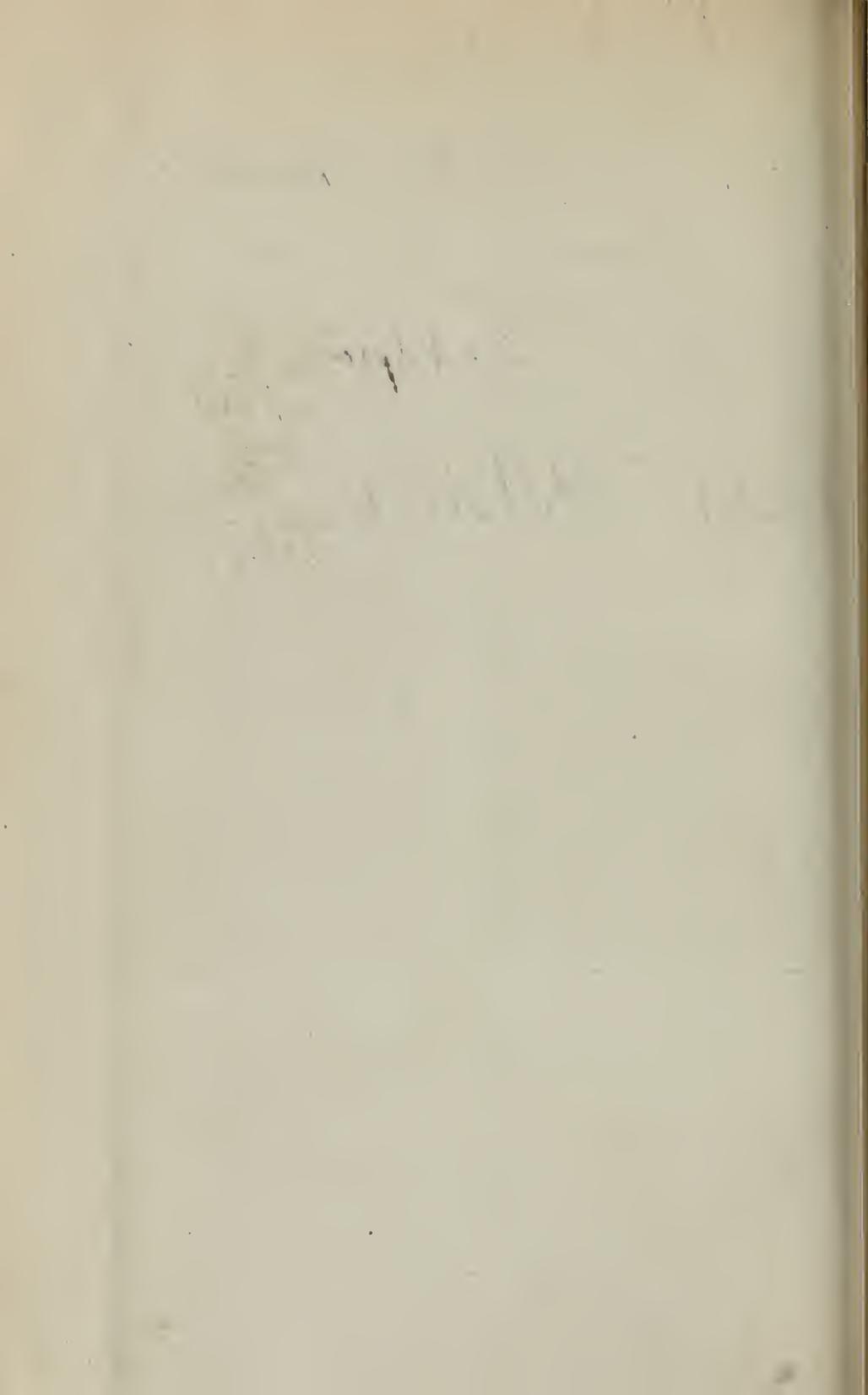
Geo H Sprouls

Clerk of the District Court of the United
States, for the District of Montana.

(Seal)

By H H Walker

Deputy Clerk.



UNITED STATES DISTRICT COURT,

DISTRICT OF MONTANA.

MINERALS SEPARATION, LIMITED,
Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY,
LIMITED,
Defendant.

In Equity.

The examination of witnesses *de bene esse* and pursuant to order of court, beginning on the 5th day of May, 1914, on behalf of the plaintiff, before me, Harry C. Lewis, a notary public in and for the County of the Bronx, certificate filed in the County of New York and authorized to act as a Notary Public in the County of New York, State of New York, at the office of Henry D. Williams, Esq., No. 76 Williams Street, in the County of New York and said State, in the above entitled suit.

Present :

HENRY D. WILLIAMS, ESQ., of Counsel for the
Plaintiff.

THOMAS F. SHERIDAN, ESQ., and WALTER A. SCOTT,
ESQ., of Counsel for Defendant.

HUGH N. LINE, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows :

DIRECT EXAMINATION BY MR. WILLIAMS :

1 Q. Please state your name, age, residence and occupation.

A. Hugh N. Line ; 41 years old ; Bartlesville, Oklahoma ; contractor for loading and unloading material for the smelters.

2 Q. And what is the material which you usually load and unload for the smeltery ?

A. Coal and ore, I unload, and clay. I load cinders and do other work for the Company.

3 Q. And what is the name of the Company ?

A. National Zinc.

4 Q. Please relate the circumstances connected with obtaining a specimen of ore or concentrate at the Bartlesville Zinc Company, near Bartlesville, Oklahoma.

A. On the 18th day of September, 1913, Mr. Gill and Mr. Jacobsen, they came where I was working and said they wanted me to do some work for them. I asked them to state the case and they told me they wanted me to secure a sample of ore from the Bartlesville Zinc Company at No. 2 Works, and they wanted a muddy slime called the Butte ore. I went and secured a sample. I was there present when the men opened the car. I went in and secured a sample. I then placed it in a bag marked "\$100"—and I believe it was the Bartlesville Union National Bank—I took it to the No. 3 office and gave it to Mr. Jacobsen and Mr. Gill. I also got the seal of the car and the number of it.

5 Q. Was the seal of the car broken in your presence ?

A. Yes.

6 Q. What is this I now hand you (hands piece of tin) ?

A. This is the seal as best I can tell, the same number ; 833,664 and " Great Northern Ry. Line," with the letter " H " on the rivet of the seal.

7 Q. What is it I now hand you (handing slip of paper to witness) ?

A. This is the number of the car and the title of it " S 15679".

8 Q. About how much of the material of which you took a specimen was there in the car ?

A. I would judge there was 80,000 or 100,000 pounds in the car.

9 Q. What is the No. 3 Office, to which you took this sample ?

A. That is the National Zinc Company No. 3 Office.

10 Q. When did you put this specimen in the bag?

A. In a few minutes after I procured it.

11 Q. What further happened in regard to this specimen in the bag at No. 3 Office and afterward?

A. Well, we put it in there in the bag and sealed it up and I kept it in my possession until that evening; then we went to Rowland & Talbot and there we sealed it with red and green sealing wax.

12 Q. Did you put anything else in the bag besides the specimen of muddy slime?

A. Yes, sir, put the seal of the car and the number of the car on a white slip of paper, written with a pencil. And we tied the sack with a grayish twine and the imprint of the seal on the wax was Rowland & Talbot; then I delivered it to Mr. Jacobsen.

13 Q. What is it that I now show you (hands witness a bag)?

A. That is the bag I described or one just like it. The sealing and tying is the same or just like it. The material in the bag looks like the same material, dry.

14 Q. What is the document I now show you (hands witness document)?

A. That is the affidavit I made that day, signed and sworn to by me.

MR. WILLIAMS: The metal seal shown to the witness is marked for identification "Seal of Car," the slip of paper described as containing the number of the car is marked for identification "Memorandum of Number of Car," and the bag shown to the witness, with attached sealing [and contents, is marked for identification "Defendant's Concentrate No. 2," and the affidavit shown to the witness is marked "Line First Affidavit."

Direct-examination closed.

No cross-examination.

Deposition closed.

ERNEST O. JACOBSEN, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows :

DIRECT EXAMINATION BY MR. WILLIAMS :

Q. 1. Please state your name, age, residence and occupation.

A. Ernest O. Jacobsen ; 48 years old ; living at 304 West Seventy-first street, New York City ; secretary and treasurer of the National Zinc Company.

Q. 2. Where were you on September 18, 1913 ?

A. In Bartlesville, Oklahoma.

Q. 3. Where is the plant of the Bartlesville Zinc Company ?

A. Near Bartlesville, Oklahoma.

Q. 4. Did you on that day meet Hugh N. Line, who has just testified as a witness, and what, if anything, did you ask him to do ?

A. I met Mr. Line in conjunction with Mr. Gill, superintendent of the National Zinc Company's plant near Bartlesville, Oklahoma, and requested Mr. Line to obtain, if possible, a sample of ore known as the Butte & Superior ore arriving at the works of the Bartlesville Zinc Company.

Q. 5. And what, if anything, happened in relation thereto ?

A. Mr. Line brought to me, while in the office of the National Zinc Company, a bag containing a wet substance, which he said he had obtained from a car at the Bartlesville Zinc Company's Works, and we went to the law office of Rowland & Talbot in the City of Bartlesville, where, in my presence, Mr. Line put in the bag a strip of tin and a piece of white paper, the latter being marked with the number which he said was the number of the car from which he had obtained the contents of the bag. The bag was then tied and sealed with a red and green seal and marked "Rowland & Talbot." Mr. Line thereupon gave me the bag, which I kept in my possession and brought with me to New York, delivering same to you.

6 Q. At the time that you delivered this bag and its contents to me, was or was not the bag still sealed up ?

A. The bag was still sealed up.

7 Q. When and in whose presence was the bag opened?

A. On the 25th of September, the day that I came into your office, the bag was opened in the presence of yourself, Dr. Charles F. Chandler and I think Mr. George A. Chapman was there, and myself. The contents of the bag were examined by all present, Dr. Chandler taking a sample.

8 Q. I now show you the bag which was marked for identification during the taking of the deposition of Mr. Line and the metal seal and piece of paper also so marked, and ask you whether or not they appear to be the various articles so described by you and delivered to me?

A. They do.

Direct examination closed.

No cross-examination.

Deposition closed.

Adjourned to Wednesday, May 6, 1914, at the same place, at eleven o'clock A. M.

NEW YORK, May 6, 1914.

Met pursuant to adjournment.

Present: Counsel as before.

CHARLES F. CHANDLER, a witness produced on behalf of the plaintiff, being first duly cautioned and sworn, deposes and says as follows:

DIRECT EXAMINATION BY MR. WILLIAMS:

1 Q. Please state your name, age, residence and occupation?

A. Charles Frederick Chandler; age, 77 years; residence, New York City; chemist by profession.

2 Q. Are you the same Charles F. Chandler who testified

as a witness for the complainants in the suit of Mineral Separation, Limited, and another, vs. James M. Hyde ?

A. I am.

3 Q. Were you in my office on September 25, 1913, and, if so, please relate the circumstances in connection with a specimen which was present on that occasion ?

A. I was present in your office on this date and, beside yourself, Mr. E. O. Jacobsen was present. A cotton bag was produced marked "\$100 Silver" in red, and under that in black "Bartlesville National Bank, Bartlesville, Okla." In between the red and black descriptions above mentioned were two red lines which were very indistinct and I did not try to decipher them. The bag was tied with heavy hemp twine and sealed with red sealing wax, underneath which was dark green sealing wax. The seal covered the knot in full contact with it, and everything was intact. Just as the twine was cut by myself, Mr. George A. Chapman came in and remained to the end of the interview.

On opening the bag, a piece of white paper was found therein marked "Car No. S 15679." There was also found in the bag a narrow strip of tin plate about seven inches long and a third of an inch wide, with the following inscription in black: "Great Northern Ry. Line 833664"; and on the rivet head holding the two ends together originally appeared the letter "H."

The ore within the bag had become hardened into a solid lump. This was broken by physical force applied outside and the contents of the bag were poured out and thoroughly mixed. Half of this I took charge of and returned the other half to the bag, and tied it up as before and left it in the custody of Mr. Williams, together with the paper and strip of tin.

The moist ore, as well as the bag, had a very strong odor, apparently of an essential oil, probably eucalyptus.

This is the memorandum which I made at the time.

4 Q. What did you do with this specimen of ore that you took charge of ?

A. I took it to my laboratory at Columbia University and subjected it to chemical examination. I weighed out 150 grams of the moist ore and extracted it repeatedly with

ether. On evaporating the ether in a weighed dish, there was left an oily residuum which amounted in weight to 0.24 per cent. This appeared to be a mixture of light and heavy oil and, when cold, indicated the presence of stearic acid by becoming semi-solid, stearic acid being a common constituent of commercial oleic acid. The solubility of a considerable portion of the oily material in alcohol satisfied me that a large proportion of it was commercial oleic acid. From the odor of the original ore in its moist condition, I concluded that a portion of the oily matter was probably either pine oil or eucalyptus oil, I couldn't decide which. The water in the sample amounted to 3.29 per cent., probably a little less than this in fact, because the water was determined by subtracting the joint weight of the oil recovered and the dry ore freed from oil and water from 100 per cent.; probably the oil recovered did not completely represent the oil in the sample, as the odor which I thought came from eucalyptus oil or pine oil disappeared during the evaporation of the ether, so probably the amount of oil was a little more than 0.24 per cent. and the water less than 3.29.

The following tabular statement indicates the results actually obtained from this examination :

Mineral.....	96.47
Water.....	3.29
Oil	0.24
	100.00

I subjected the mineral, after it was freed from oil and water, to a partial chemical analysis, with the following result :

Zinc	42.22
Sulphur calculated.....	20.71
	62.93
Sulphide of Zinc	62.93
Copper	0.62
Residue insoluble in acids.....	24.57
Undetermined	11.88
	100.00

The undetermined includes iron, sulphur combined with the iron and the copper, manganese, carbon dioxide, and other substances dissolved by the acids used.

5 Q. Have you made a screen analysis of this material, and, if so, when did you make and with what results?

A. The end of April I came to Mr. Williams office and borrowed the bag of ore that I have previously described, which had been left with him for safe keeping. I took it to the University. I found it had caked together again, I crushed it with my hands so as to get it out of the bag, and then broke up the lumps in a glazed porcelain mortar, I did not triturate it; that is to say, I did not make the particles any finer than they were originally. I merely broke up the lumps so the material could be sifted. I weighed the whole and found that it amounted to 423.35 grams. I first tried it on a 80-mesh sieve and it all went through. I then sifted it on a 150-mesh sieve and 401 grams went through, leaving 22.35 grams that did not go through. Reduced to percentages, the figures are as follows:

94.72 per cent. passed through 150-mesh sieve.

5.28 " " did not.

100.00 " " through 80-mesh sieve.

I then returned both these portions to the rest of the contents of the bag and thoroughly mixed them and took 100 grams of the dry powder and extracted it with ether five times in succession. The ethereal solutions were evaporated in a weighed dish and the oily product, solid at room temperature, weighed 0.1165 grams, which, of course, represents the percentage. This is considerably smaller than the residue obtained originally last September, when the material was wet and fresh, owing to the fact that the more volatile portions of the oil had evaporated in the meantime, as was the case with the water originally recovered, and probably some of the oily matter had been rendered insoluble in ether by oxidation.

6 Q. Have you anything to add as to the analysis made by you in September, 1913?

A. There were two things that didn't occur to me to

mention : one was that the sample that I treated with ether last September was put in a mortar and pulverized, simply to break up the lumps which had formed by agglutinating action of the water or the oil, not for the purpose of making the particles any smaller ; and I omitted to mention the fact that last September I tested for sulphuric acid and hydrochloric acid ; I obtained a slight reaction for each, but as the blue litmus paper was not reddened, the quantity must have been extremely small or the acid must have been neutralized probably by some constituent of the ore.

7 Q. What became of the portion of the specimen which you took from my office in September, 1913, and from which you took the 150 grams specimen for chemical analysis ?

A. I returned it to you when the analysis was complete, and I now produce the bottle containing my laboratory number 4390 and marked "Original sample received from Mr. Williams, Sep. 25, 1913, C. F. Chandler,

Wt. Bottle	315.5 gram
“ “ + ORE	617.5

Ore	302.”

8 Q. I now show you a bag marked for identification "Defendant's Concentrate No. 2", a strip of tin marked for identification "Seal of Car", and a piece of white paper marked for identification "Memorandum of number of Car" and ask you if you recognize those articles ?

A. I do. They are the ones which I have mentioned at the beginning of my testimony.

"MR. WILLIAMS : The specimen in bottle, produced by the witness, is marked for identification "Original Chandler Sample".

9 Q. Relative to the amount of oil which you determined to be present in this material when examined by you in September, 1913, you say at the end of your answer to 4 Q. : "Probably the amount of oil was a little more than 0.24 per cent."

Can you say anything further in amplification of this statement?

A. I can only say that this was an interference which I drew from the fact that I did not detect in the oil which I extracted the delicate odor which the original ore gave off and which led me to suspect the presence of some eucalyptus or pine oil. I had no other means of forming an opinion that the oil which I weighed did not represent all the oil in the original sample.

10 Q. Could you give any representation in figures of the probable amount of oil which may have evaporated?

A. I cannot. I know it takes a very small quantity of material having a characteristic odor to display that odor. As an illustration: the odor of whiskey, brandy, rum, wine, beer is produced by small fractions of one per cent. of material; in fact, strong odors are produced by unweighable quantities of material.

Direct examination closed.

CROSS-EXAMINATION BY MR. SCOTT:

11 x-Q. The odor which was observed in the sample before extraction with ether, which odor disappeared after the evaporation with ether, simply indicated the fact that some oil disappeared without affording any indication as to how much disappeared?

A. Well, it indicated that the odor disappeared and that the substance which produced the odor probably disappeared, or else the odor of the ether employed may have masked the odor which the oil originally exhibited.

12 x-Q. There is no certain way, is there, of determining just what did happen?

A. No. Oxidation may have occurred and rendered the oil odorless.

13 x-Q. Did the oil which you finally obtained after the evaporation of the ether still have an odor of ether?

A. It did.

14 x-Q. Thus indicating that the oil was not completely freed from the ether?

A. Well, I shouldn't like to say that exactly, because there is an ethereal odor generally left in liquids extracted by means of ether. I don't think that is due to ether, but something in the ether which has this peculiar odor; some minute quantity of some foreign substance which is left behind.

15 x-Q. Did the facts observed by you, as stated in your direct examination, bear any evidence to your mind that the concentrate which you examined had ever existed in the form of what has been termed a froth or scum?

A. There were certain features which I noticed which are characteristic of material thus obtained, as a froth or scum. The first sample of material which I ever examined in connection with this subject was a sample of froth which was collected by Mr. Nutter. He put this froth into a bottle, sealed it up, sent it to Mr. Williams, and I opened it, so I had an opportunity to examine this sample of froth in its original condition, and its characteristics are precisely those of the material that was contained in the bag which has been introduced to-day as an exhibit. It was extremely fine powder, what I should think would be called slime in metallurgical language. It contained a small percentage of water, and it contained a still smaller percentage of oil. The water and oil were sufficient to cause the particles to adhere to each other to a greater or less degree, which I think would not have been the case if the material had not been a froth or scum.

16 x-Q. In what manner was the oil distributed through the mass of concentrate which was brought from Bartlesville in regard to which you have testified?

A. It was evidently uniformly distributed, for, when I examined it originally, no part of it seemed to appear differently from any other part of it; that is to say, there was no evidence of unequal distribution. It seemed to be perfectly uniform.

17 x-Q. Was the oil present in particles separate from the concentrate or was it attached to the particles of concentrate?

A. There were no oil particles visible; there was nothing to be seen but particles of mineral, and for that reason I think the oil was distributed uniformly over each particle of mineral.

18 x-Q. You have referred to certain characteristics of this concentrate which incline you to the belief that the concen-

trate once existed in the form of a froth or scum. Is this disposition of the oil as a coating over the concentrate particles one of those characteristics that have led you to the belief that this concentrate was floated as a froth or scum ?

A. I concluded that it was a froth or scum because I could not discover any difference in its appearance from the sample froth which Mr. Nutter has testified that he took from the top of a spitzkasten himself. Of course, it was impossible for me to determine whether each particle of mineral in this bag sample had a coating of oil upon it. It would be impossible to ascertain that by any observation that any one could make, but the uniformity in the appearance of the material led me to conclude that the oil was uniformly distributed throughout. If anyone had dropped oil upon a powder of this kind, wherever a drop came in contact with the powder the powder would become wet with oil and an oily spot would be visible to the eye, and it would be very difficult to distribute those drops of oil through the mass of powder so as to give it a uniform appearance.

19 x-Q. Is it your opinion that, in the concentrate as it originally existed when brought from Bartlesville, the oil was distributed as a coating upon the particles forming the concentrate ?

A. It is my opinion. I don't mean to say, of course, that the different particles which were present in this mixture of different minerals were equally coated, because it is a well known fact that, when such a finely divided mass of mineral material consisting of several minerals is exposed to oil and water, some minerals such as zinc blende, have a much greater affinity for oil than other minerals, and, consequently, in such a mixture of particles the particles of zinc blende would have a larger amount of oil than the particles of some of the gangue minerals associated with it, and, of course, I am not sure that there may not be some gangue minerals which have not any oil. The philosophy of using the oil is based upon this fact that zinc blende has an affinity for oil, takes it, and then when the agitation mixes the water and ore and oil together, the zinc blende particles, being coated with oil, are entangled by the air and microscopic bubbles are produced of air enclosed in a film composed of these zinc blende particles and

they come to the top as a froth or a foam. Incidentally, small quantities of the gangue minerals get entangled among these bubbles of the foam and the consequence is that this foam, when it is dried and its mineral constituents determined, is always found to contain some of the gangue material. Whether those particles of gangue were actually coated with oil or not, it is impossible to determine. They might have been brought up mechanically without being oiled.

20 x-Q. Does the determination which you made of the quantity of oil upon the Bartlesville concentrate lead you to any conclusion regarding the amount of oil which was originally applied to the entire ore ?

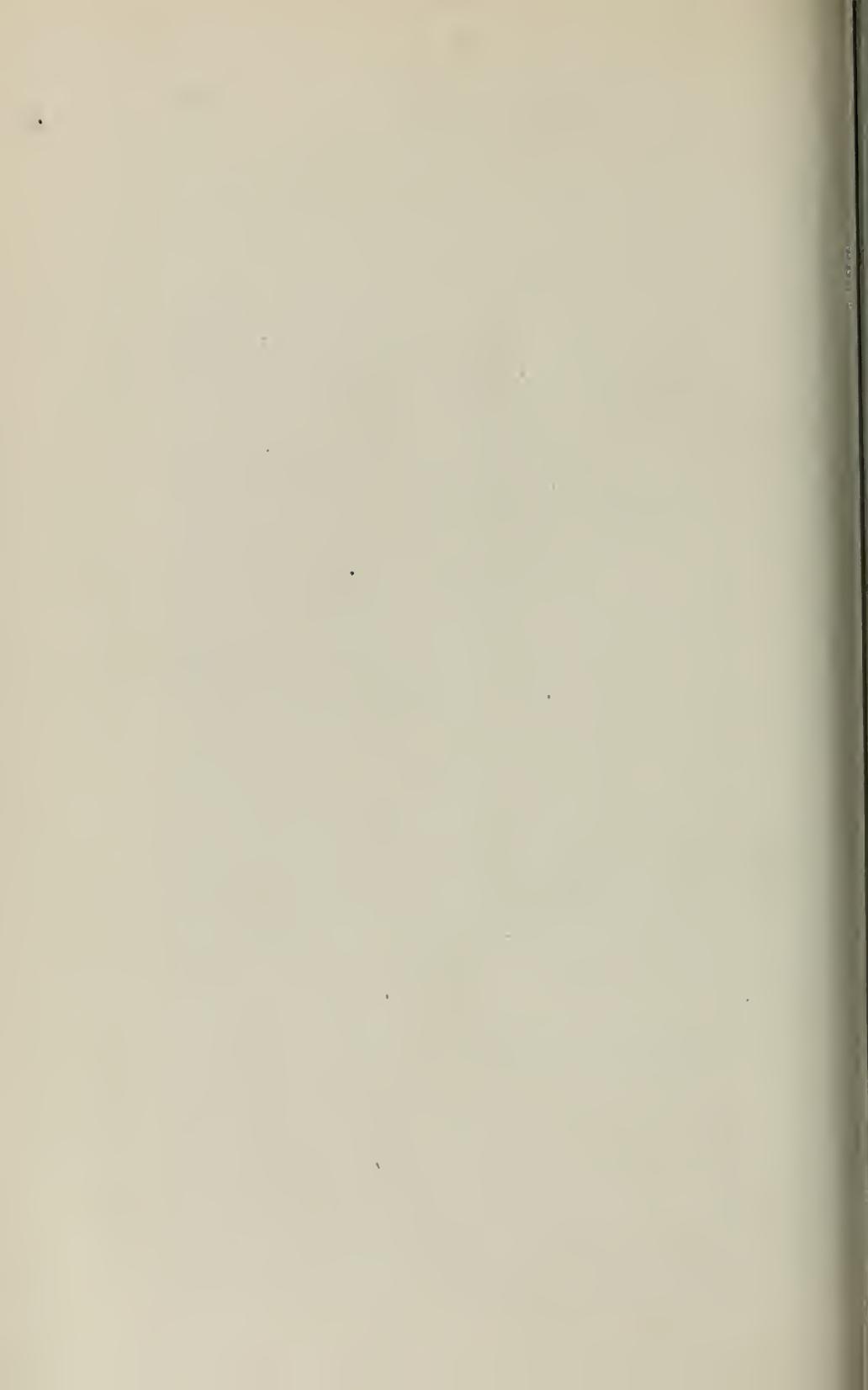
A. No, it does not, because I don't know how much zinc blende there was in the ore originally and I don't know how much zinc blende was left behind in the tailings.

21 x-Q. Is the particular amount of oil found upon a concentrate such as the Bartlesville concentrate one of those characteristics which you have referred to as leading you to the conclusion that the concentrate was separated as a froth or scum ?

A. Yes, it is ; such a small quantity of oil is characteristic of metallic minerals separated in the form of a foam from the original ore. I don't know of any other process that would leave so small a quantity of oil in the concentrate. At all events, I base my opinion on the comparison of this bag sample with the froth sample which I received from Mr. Nutter. There was an entire agreement in their characteristics.

Cross-examination closed.

Deposition closed.



CORRECTED
3081

2

United States Circuit Court of Appeals

For the Ninth Circuit.

MINERALS SEPARATION, LTD.,
Appellees,

vs.

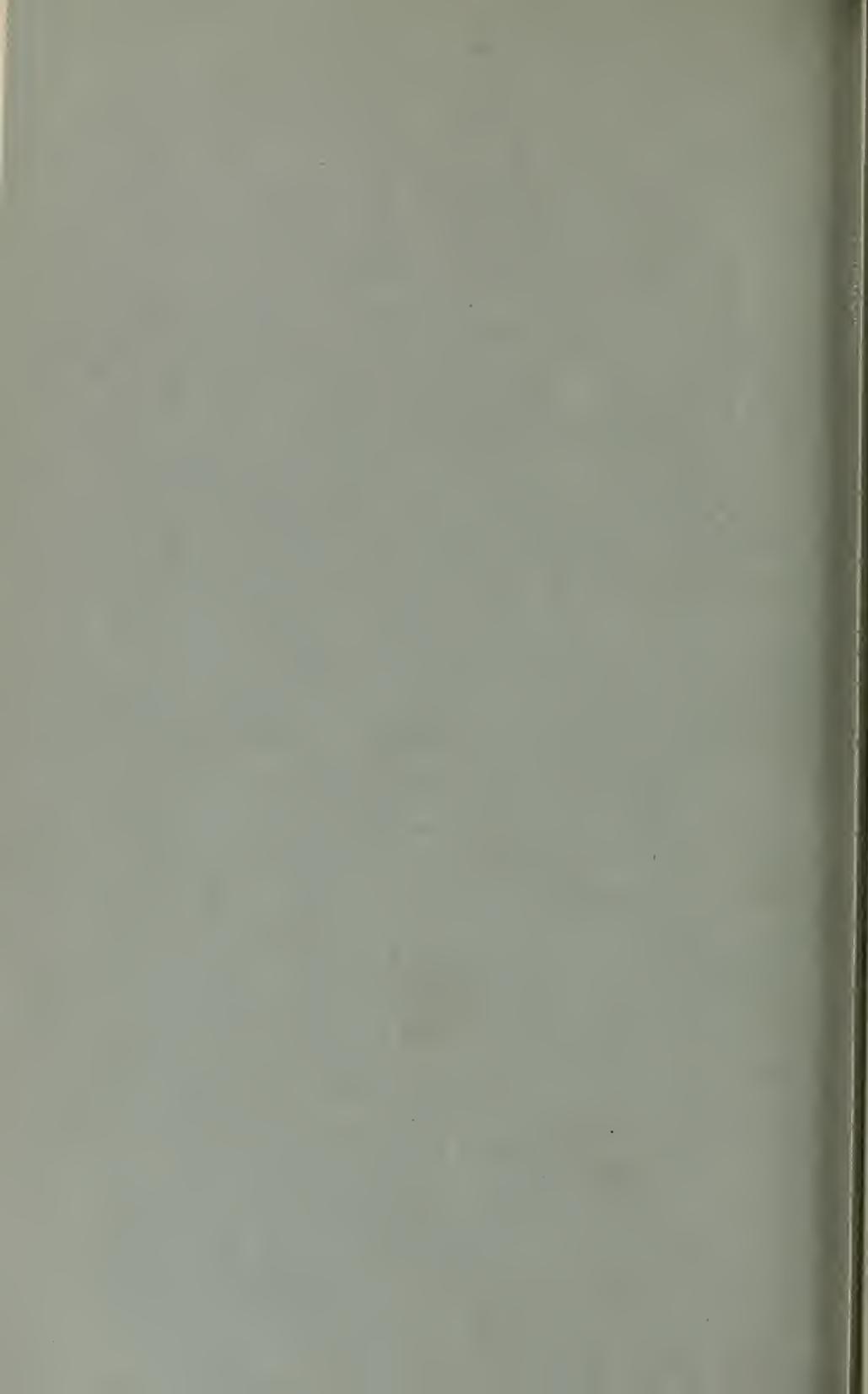
BUTTE & SUPERIOR MINING
COMPANY,
Appellant.

Transcript of Record

Volume 10--ERRATA

UPON APPEAL FROM THE UNITED STATES
DISTRICT COURT FOR THE DISTRICT
OF MONTANA

FILED
JUN 12 1919



ERRATA.

VOLUME I.

- P. III, L. 13, "statute" should read "statutes"
- P. V, L. 11, "matter" should read "master"
- P. XII, L. 11, after "company" insert "Limited"
- P. XIV, L. 16, "2" should read "3"
- P. XVII, LL. 3 & 4, "and judging" should read "adjudging"
- P. XXIII, L. 13, "F. E. Elmore" should read "A. S. Elmore"
- P. " L. 14, " " " " " " " " " "
- P. XXIV, L. 4, "Gabbet" should read "Gabbett"
- P. XXVIII, L. 10, after "here" insert "in"
- P. XXXI, L. 7, "27th" should read "28th"
- P. XXXIII, L. 14, "Comes now" should read "Now Comes"
- P. XXXIV, L. 6, after "Office" insert "an application for Letters Patent and that Letters Patent"
- P. " LL. 8 & 9, cancel "by the applicants for patent"
- P. " L. 11, "has" should read "had"
- P. XXXV, L. 14, "or" should read "and"
- P. " L. 12, cancel "an"
- P. XXXVI, L. 12, "forth" should read "up"
- P. XXXVII, L. 1, cancel "said"
- P. XXXVIII, L. 11, after "maintain" insert "an"
- P. XXXIX, L. 3, "and" should read "any"
- P. XL, LL. 4 & 5, "J. Bruce Kremer" place before "W. A. Scott"
- P. XLIV, L. 8, should read "768,035 Aug. 23, 1904 G. D. Delprat"
- P. " L. 9, should read "777,273 Dec. 13, 1904 A. E. Cattermole"
- P. " L. 15, "G. V. Potter" should read "C. V. Potter"
- P. LVIII, L. 20, "judgment" should read "injunction"
- P. LXI, L. 10, "1913" should read "1903"
- P. " L. 23, "paragraph" should read "paragraphs"
- P. " L. 27, "application" should read "applications"
- P. LXIII, L. 20, "707,506" should read "807,506"
- P. LXXI, L. 16, "1917" should read "1913"
- P. LXXX, L. 25, "assitsing" should read "assisting"
- P. LXXXIII, L. 6, "Chairman" should read "President"
- P. LXXXV, L. 29, "Isinger" should read "Insinger"
- P. LXXXVI, L. 11, after "benefit" insert "and"
- P. LXXXIX, L. 6, "expense" should read "expenses"
- P. XCI, L. 20, "De Bavey" should read "De Bavay"
- P. XCIII, L. 23, "12-12-11" should read "19-12-11"
- P. XCIV, L. 8, after "179,523" insert "21-5-13"
- P. XCVI, L. 13, "H. A. Krohm" should read "H. A. Krohn"
- P. C, L. 9, "to" should read "or"
- P. CIII, L. 16, "Owne's" should read "Owen's"
- P. CV, L. 5, "Air Bubbles" should read "Separator"
- P. CVI, Ll. 17 & 18, Cancel

- P. CVI, L. 21, "Owne's" should read "Owen's"
- P. CVIII, Ll. 1 & 2, Cancel
- P. " L. 11, "Owne's" should read "Owen's"
- P. CX, L. 19, "Deslodge" should read "Desloge"
- P. CXIII, Bet. Ll. 10 & 11, insert "Cost of appellants"
- P. CXXII, L. 30, "patents" should read "patent"
- P. CXXIV, L. 10, "Mineral" should read "Minerals"
- P. " L. 30, "invention" should read "inventions" and
"patentee" should read "patentees" and
before the period insert "or that either or
any of them was a new or original invention
of the patentee thereof."
- P. CXLIII, L. 27, after "which" insert "is"
- P. CL, L. 3, after "amended" insert "not"
- P. " L. 22, "Hayles" should read "Haynes"
- P. CLII, L. 6, after "Vol." insert "156"
- P. CLIII, L. 8, "H. Bradfond" should read "H. Brad-
ford"
- P. " L. 11, "E. A. Hieckley" should read "E. A.
Hockley"
- P. " L. 28, "776,659" should read "770,659"
- P. CLX, L. 27, after "Sulman" insert "and"
- P. CLXI, L. 25, "Unted" should read "United"
- P. " L. 31, "patnt" should read "patent"
- P. CLXII, L. 32, after "claimer" insert "and the said other
plaintiffs herein have been guilty of unreason-
able neglect and delay herein in filing the
said disclaimer"
- P. CLXIV, L. 12, omit comma (,) after "separation"
- P. " L. 25, "Thomas T. Sheridan" should read "Thomas
F. Sheridan"
- P. CLXIX, L. 28, "or" should read "of"
- P. CLXXI, L. 30, "concenterating" should read "concen-
trating"
- P. CLXXV, L. 11, cancel "to"
- P. CLXXVI, L. 7, "knows" should read "known"
- P. " L. 12, "excuted" should read "executed"
- P. " L. 13, after "December" insert "14"
- P. " L. 19, "48" should read "41"
- PP. CLXXXVII, CXC, substitute pages reprinted
- P. CCI, L. 6, "infringer" should read "infringed"
- P. CCH, L. 22, cancel "to"
- P. " L. 27, "uses" should read "use"
- P. CCVII, L. 10, "disclaimed" should read "disclaimer"
- P. " L. 21, "patricularly" should read "particularly"
- P. " L. 25, "disclaiming" should read "dismissing"
- P. CCX, L. 31, "defendants" should read "defendant"
- P. CCXIV, L. 14, before "Day" insert "17th"
- P. CCXV, L. 17, after "Court" insert "of"
- P. CCXXV, L. 4, "trasncript" should read "Transcript"

ERRATA.

VOLUME II.

- P. 20, L. 23, "fuly" should read "fully "
- P. 26, L. 8, after " and " insert " as "
- P. 40, L. 27, "opeend" should read "opened "
- P. 45, L. 9, "Side" should read "Slide "
- P. 60, L. 29, "demended" should read "demanded "
- P. 64, L. 22, should read "vacuum chamber should be observed through glass win- "
- P. 64, L. 23, should read "dows provided for the purpose and was confined to an "
- P. 70, L. 20, "precedure" should read "procedure "
- P. 72, L. 28, "notice" should read "noticed "
- P. 78, L. 23, "fould" should read "would "
- P. 80, L. 11, after "say" insert "just "
- P. 80, L. 28, "nessitate" should read "necessitate "
- P. 82, LL. 10 & 11, "con-dition" should read "relation "
- P. 83, L. 26, "test" should read "tests "
- P. 86, L. 14, after "such" insert "an "
- P. 88, L. 8, "unforseen" should read "unforeseen "
- P. 96, L. 6, "diametrical" should read "diametrical "
- P. 97, L. 27, "that ", should read "this "
- P. 101, L. 27, "instancee" should read "instances "
- P. 102, L. 27, "ore" should read "ores "
- P. 106, L. 8, "therto" should read "thereto "
- P. 108, L. 6, "here" should read "there "
- P. 110, L. 28, after "present" insert "in "
- P. 110, L. 29, "in sufficient" should read "insufficient "
- P. 118, L. 28, "267 x-Q." should read "257 x-Q."
- P. 122, L. 12, "flota-" should read "flota-"
- P. 124, L. 29, "of" should read "or "
- P. 128, L. 27, after "did he" insert "not "
- P. 129, L. 21, before "stat-" insert "have "
- P. 131, L. 9, "referencess" should read "references "
- P. 138, L. 23, "bing" should read "being "
- P. 138, L. 24, after "matter" insert "remaining below from the non-metalliferous matter "
- P. 142, L. 20, omit colon (;) after "ore "
- P. 143, L. 19, comma (,) before parenthesis place *after*)
- P. 143, L. 21, after "forms" insert "into "
- P. 147, L. 7, "mtealliferous" should read "metalliferous "
- P. 156, L. 8, "aleic" should read "oleic "
- P. 162, L. 11, "oelic" should read "oleic "
- P. 170, L. 7, "19 Q" should read "19 XQ "
- P. 173, L. 25, "ferrufinous" should read "ferruginous "
- P. 178, L. 29, after "patent" insert "in "
- P. 184, L. 28, "entirely" should read "entirety "
- P. 185, L. 10, "simply" should read "simple "

- P. 187, L. 20, after " with " insert " in "
- P. 189, L. 23, before " make " insert " may "
- P. 195, Ll. 26-28, cancel from " I have " to " spitzkasten "
- P. 197, L. 27, after " ores " insert " are alike in their composition and consequently no two ores "
- P. 200, L. 13, " patentes " should read " patentee "
- P. 215, L. 25, " thes " should read " these "
- P. 218, L. 12, " granulatoin " should read " granulation "
- P. 218, L. 28, after " is " insert " all that is "
- P. 220, L. 13, " wthin " should read " within "
- P. 220, L. 14, cancel " or hinted at " and before the question mark insert " As a matter of fact, would you know, under these circumstances, whether the amount of oil supplied came within proportions referred to or hinted at in the patent in suit ? "
- P. 220, L. 17, " contnuous " should read " continuous " and " beileved " should read " believed "
- P. 221, L. 22, " sixteen " should read " sixteen "
- P. 223, L. 20, " introduc " should read " introduced "
- P. 226, L. 22, " matter " should read " material "
- P. 232, L. 19, " Holhorn " should read " Holborn "
- P. 236, L. 3, after " form of " insert " flocks of "
- P. 236, L. 13, after " were " insert " lifted bodily by the gas to the surface of the liquor, and secondly the portion of the concentrates that were "
- P. 244, L. 29, cancel " Below the sec. "
- P. 244, L. 30, cancel " ond series was another upcast separator "
- P. 246, L. 22, " arangement " should read " arrangement "
- P. 247, L. 5, " charcteristics " should read " characteristics "
- P. 249, L. 19, after " pulp " insert " downwardly and two were fixed so as to beat the agitated pulp "
- P. 250, L. 10, " seperation " should read " separation "
- P. 251, L. 22, cancel " found "
- P. 254, L. 23, after " him " insert " by "
- P. 256, L. 9, " THerfore " should read " therefore "
- P. 269, L. 22, " Leachman " should read " Leechman "
- P. 271, L. 11, " 68Q " should read " 69Q "
- P. 277, L. 4, after " worthless " insert " magnetic "
- P. 277, L. 26, " tartes " should read " trators "
- P. 280, L. 3, " Amylocetate " should read " Amylacetate "
- P. 283, L. 9, " feed oil " should read " oil feed "
- P. 284, L. 14, after " pounds " insert " per ton, the oil consumption was three pounds "
- P. 284, L. 18, after " copper " insert " the original ore content being roughly 3 per cent of copper "
- P. 287, L. 16, " treated " should read " tested "
- P. 288, L. 27, " parafine " should read " paraffine "
- P. 290, L. 23, " sufficient " should read " insufficient "
- P. 293, L. 6, after " addition " insert " of acid "
- P. 295, L. 15, after " was to " insert " oil "
- P. 302, L. 4, " refered " should read " referred "

- P. 307, L. 3, " A " should read " 195 "
- P. 311, L. 2, " aid " should read " air "
- P. 314, L. 15, " calcite " should read " calcitic "
- P. 314, L. 17, " vulty " should read " culty "
- P. 315, L. 5, " refernce " should read " reference "
- P. 317, L. 6, " cite " should read " citic "
- P. 317, L. 12, " calcite " should read " calcitic "
- P. 317, L. 19, cancel " and " before " you "
- P. 330, L. 10, cancel " not "
- P. 337, L. 18, " gas " should read " was "
- P. 329, L. 23, " cincentrates-vat " should read " concentrates-vat "
- P. 329, L. 25, before " consulting " insert " the "
- P. 332, L. 20, " Pickard " should read " Picard "
- P. 333, L. 19, " aranged " should read " arranged "
- P. 334, L. 23, " is " should read " if "
- P. 335, L. 10, " Effetced " should read " effected "
- P. 342, L. 19, " xtended " should read " extended "
- P. 357, L. 2, " constatnly " should read " constantly "
- P. 367, L. 2, cancel " had "
- P. 371, L. 19, " 1907 " should read " 1905 "
- P. 382, L. 10, " any " should read " an "
- P. 386, L. 27 & 29, " Schwartz " should read " Schwarz "
- P. 387, L. 5, " mode " should read " made "
- P. 388, L. 6, change " process " to " processes "
- P. 389, L. 15, " 52560 " should read " 5260 "
- P. 392, L. 1, after " milling " insert " an "
- P. 400, L. 17, " sepартely " should read " separately "
- P. 400, L. 20, " concentraion " should read " concentration "
- P. 409, L. 6, after " about " insert " to "
- P. 409, L. 25, " Mesrs." should read " Messrs."
- P. 410, L. 11, " Leehman " should read " Leechman "
- P. 410, L. 17, " thes " should read " these "
- P. 413, L. 22, after " which " insert " was "
- P. 419, L. 7, after " purpose of " insert " the "
- P. 421, L. 8, " liimts " should read " limits "
- P. 421, L. 27, " acod " should read " acid "
- P. 422, L. 30, " powderd " should read " powdered "
- P. 423, L. 30, " 1912 " should read " 1902 "
- P. 427, L. 4, " only " should read " oily "
- P. 427, L. 7, " sing " should read " sink "
- P. 441, L. 13, cancel second " would "
- P. 444, L. 9, " seventeenth " should read " seven tenths "
- P. 445, L. 14, " opinon " should read " opinion "
- P. 451, L. 18, after " connection " insert " it is important that
that operation is entirely distinct "
- P. 461, L. 20, " Forment's " should read " Froment's "
- P. 444, L. 26, after " if " insert " in "
- P. 464, L. 10, " application " should read " applicatious "
- P. 464, L. 13, " indriectly " should read " indirectly "
- P. 466, L. 7, " Devision " should read " Decision "
- P. 467, L. 12, " concentartes " should read " concentrates "

- P. 468, L. 6, "nothwithstanding" should read "notwithstand-
ing"
- P. 472, L. 19, "Swanea" should read "Swansea"
- P. 477, L. 6, "83 x-Q." should read "33 x-Q."
- P. 480, L. 9, "section" should read "sectional"
- P. 484, L. 10, "of" should read "on" after "manager"
- P. 485, L. 14, "advertisong" should read "advertising"
- P. 504, L. 13, "bythe" should read "by the"
- P. 507, L. 7, after "plants" insert "first"
- P. 510, L. 16, "sectiin" should read "section"
- P. 510, L. 28, "sectiin" should read "section"
- P. 515, L. 2, "ths" should read "the"
- P. 524, L. 29, "January" should read "January"
- P. 532, L. 3, "cncen-" should read "concen-"
- P. 532, L. 4, "tratin" should read "tration"
- P. 533, L. 19, "metalurgical" should read "metallurgical"
- P. 536, L. 7, "process" should read "processes"
- P. 537, L. 6, "explans" should read "explains"
- P. 563, L. 17, "earthly" should read "earthy"
- P. 564, L. 19, "of" should read "or"
- P. 565, L. 16, "Elmre" should read "Elmore"
- P. 571, L. 9, "breathing" should read "beating"
- P. 575, L. 14, "diagramatic" should read "diagrammatic"
- P. 579, L. 20, "derivities" should read "derivatives"
- P. 591, L. 26, "patantees" should read "patentees"
- P. 592, L. 8, "adourment" should read "adjournment"
- P. 593, L. 26, "783" should read "793"
- P. 601, L. 7, "loking" should read "looking"
- P. 602, L. 19, "with the" should read "and"
- P. 603, L. 5, "speration" should read "separation"
- P. 605, L. 14, "thorough" should read "thorough"
- P. 605, L. 25, "Schwartz" should read "Schwarz"
- P. 613, L. 2, "cer-" should read "ver-"
- P. 614, L. 25, after "rising" insert "air"
- P. 619, L. 10, "defndant's" should read "defendant's"
- P. 327, L. 13, "oil-mostened" should read "oil-moistened"
- P. 632, L. 7, "finishing" should read "finishing"
- P. 633, L. 23, after "of" insert "a"
- P. 643, L. 23, after "or" insert "a"
- P. 651, L. 7, "generaiting" should read "generating"
- P. 651, L. 15, after "and" insert "of"

ERRATA.

VOLUME III.

- P. 660, L. 9, ".33cc." should read ".3cc."
- P. 667, L. 13, "page" should read "pages"
- P. 670, Ll. 3 & 4, transpose these lines; and "concentrates" should read "concentrates"
- P. 670, L. 5, "visible" should read "visible"
- P. 680, L. 11, after "of" insert "air distributed throughout it, and attaching them."
- P. 680, L. 19, before "agitator" insert "an"
- P. 681, L. 16, "disclosures" should read "disclosures"
- P. 681, L. 24, "make" should read "made"
- P. 682, L. 10, insert "to" after "in"
- P. 682, L. 13, "25%" should read ".25%"
- P. 685, L. 23, cancel "fact"
- P. 693, L. 18, "oi carbonic" should read "of carbonic"
- P. 693, L. 29, "uesd" should read "used"
- P. 695, L. 9, "analysis" should read "analyses"
- P. 695, L. 23, insert period (.) after "water"
- P. 700, L. 11, insert "the" before "tailings"
- P. 704, L. 20, insert "the agitation" before "a froth"
- P. 708, L. 10, insert "the" before "use"
- P. 715, L. 6, "1913" should read "1903"
- P. 718, L. 2, "in" should read "to"
- P. 721, L. 13, "tremely" should read "tremely"
- P. 721, L. 27, "performed" should read "perforated"
- P. 722, L. 3, "views" should read "view"
- P. 725, L. 6, "231/2" should read "23%"
- P. 726, L. 18, "process" should read "processes"
- P. 728, L. 4, "Sec.," should read "Spec."
- P. 728, L. 8, "process" should read "processes"
- P. 728, L. 23, "Schwartz" should read "Schwarz"
- P. 729, L. 2, insert "more" before "agitators"
- P. 730, L. 2, "atmosphere" should read "atmospheric"
- P. 730, L. 4, insert "test" before "tube"
- P. 732, L. 5, "from" should read "form"
- P. 733, L. 24, "describe" should read "described"
- P. 734, L. 26, "788.147" should read "788.247"
- P. 736, L. 13, "assisted by gas" cancel. Insert (.) after "flotation"
- P. 736, L. 15, "Schwartz" should read "Schwarz"
- P. 737, L. 30, insert "the" before "severe"
- P. 740, L. 3, "by" should read "my"
- P. 740, L. 11, "bixture" should read "mixture"
- P. 741, L. 16, "12,788 of 1902" should read "12,778 of 1912"
- P. 742, L. 12, "with the" should read "with a"
- P. 742, L. 13, "260lbs." should read "360lbs."
- P. 743, L. 9, "Schwartz" should read "Schwarz"

- P. 748, L. 13, "pastry" should read "pasty"
- P. 750, L. 15, "radical" should read "radial"
- P. 752, L. 9, "753,260" should read "763,260"
- P. 759, L. 3, "171" should read "181"
- P. 760, L. 18, "consist" should read "consists"
- P. 761, L. 11, "yound" should read "pound"
- P. 761, L. 26, "say" should read "says"
- P. 768, L. 11, insert "is" before "not"
- P. 768, L. 15, "62-Q," should read "62 x-Q."
- P. 771, L. 12, "temerature" should read "température"
- P. 785, L. 18, insert "of" after "whole"
- P. 795, L. 5, "reptition" should read "repetition"
- P. 796, L. 21, cancel "the"
- P. 798, L. 24, cancel "be"
- P. 802, L. 14, "aggom-" should read "agglom-"
- P. 803, L. 28, "aggom-" should read "agglom-"
- P. 811, L. 18, "powes" should read "power"
- P. 818, L. 26, "taste" should read "state"
- P. 821, L. 11, insert "the" before "freez-"
- P. 829, L. 18, insert "layer" before "is"
- P. 833, L. 28, insert "is made to rebut them, that attempt" before "should"
- P. 838, L. 27, "result" should read "results"
- P. 841, L. 12, "0.201" should read "0.0201"
- P. 841, L. 18, "of pinoline" should read "or pinoline"
- P. 845, L. 17, "Type" should read "types"
- P. 847, L. 22, "vitrol" should read "vitriol"
- P. 849, L. 10, insert "second process described in Everson's patent for the" before "ore"
- P. 849, L. 30, insert "that" before "the result"
- P. 851, L. 10, "viscious" should read "viscous"
- P. 853, L. 28, "Adolph" should read "Adolf"
- P. 855, L. 27, "separted" should read "separated"
- P. 858, L. 12, "Pickard" should read "Picard"
- P. 859, L. 29, insert "which" before "by"
- P. 862, L. 14, insert "the" before "oil-floated"
- P. 863, L. 17, insert "au" after "by"
- P. 865, L. 27, "affecting" should read "effecting"
- P. 866, after L. 15, insert: The process is a modification of the Elmore oil flotation process, and does not in any manner resemble the process of the patent in suit. Aeration must be avoided in the mixing and separating. After the separation of the values from the gangue has been completed, the worthless residues are submitted to a treatment to recover the oil from them, this treatment consisting in blowing air through them to separate and float the oil.
- P. 869, L. 20, "25" should read "29"
- P. 873, L. 6, "under" should read "upward"
- P. 876, L. 2, insert "as" before "he"

- P. 876, L. 12, "Schwartz" should read "Schwarz"
- P. 877, L. 13, insert "air" before "bubbles"
- P. 879, L. 19, "triffle" should read "trifle"
- P. 881, L. 8, graphite" should read "graphitic"
- P. 881, L. 10, insert "is" before "clearly"
- P. 887, L. 4, insert "oil" before "process"
- P. 887, L. 18, insert "oil" before "11.7"
- P. 890, L. 16, "specification" should read "specifications"
- P. 901, L. 3, "utilized" should read "utilizable"
- P. 902, L. 19, "79,808" should read "793,808"
- P. 904, L. 15, "British" should read "Bubbles"
- P. 907, L. 28, "Hayes" should read "Haynes"
- P. 907, L. 30, "effort" should read "efforts"
- P. 912, L. 17, "grand" should read "grind"
- P. 919, L. 5, insert "and" before "particularly"
- P. 924, L. 15, "sulphides" should read "sulphide"
- P. 926, L. 29, "on" should read "of"
- P. 929, L. 5, insert "second" before "test"
- P. 935, L. 9, "8%" should read "18%"
- P. 937, L. 3, "Revov." should read "Recov."
- P. 937, L. 31, "or" should read "to"
- P. 955, L. 26, "to" should read "do"
- P. 958, L. 19, "process" should read "processes"
- P. 960, L. 10, insert "the" before "said"
- P. 960, L. 18, insert "13" before "hereof"
- P. 962, L. 25, "receipts" should read "recepts"
- P. 966, L. 3, "terms" should read "term"
- P. 966, L. 26, "offices" should read "officers"
- P. 966, L. 27, "effectively" should read "effectually"
- P. 970, L. 28, cancel "pur" and insert "clause or thereafter prior to completion of the pur-" after "this"
- P. 971, L. 20, "(d)" should read "(g)"
- P. 972, L. 13, insert "or" before "on"
- P. 974, L. 10, cancel "the"
- P. 975, L. 10, "effect" should read "affect"
- P. 978, L. 12, "Pickard" should read "Picard"
- P. 979, L. 50, "FRANCES" should read "FRANCIS"
- P. 980, L. 23, insert "of" after "day"
- P. 981, L. 6, "konwn" should read "known"
- P. 981, L. 13, "of-" should read "af-" and insert "he knew the seal of the said corporation; that" before "The"
- P. 984, L. 18, "1917" should read "1907"
- P. 986, L. 21, "crusher" should read "crushing"
- P. 987, L. 20, insert "the" before "attention"
- P. 992, L. 29, "extra" should read "extrac-"
- P. 992, L. 38, "Feau-" should read "Lean-"
- P. 998, L. 3, "connecting" should read "containing"
- P. 1000, L. 8, insert "1% of carbonate of lime, maximum" before "2%"
- P. 1000, L. 30, insert "etc" after "of oil"
- P. 1001, L. 12, insert "ore" after "rich"

- P. 1007, L. 26, "bottom" should read "bottoms"
- P. 1012, L. 7, "Experiment" should read "Experimental"
- P. 1015, L. 4, "Licenses" should read "License"
- P. 1016, L. 8, "1.154,353" should read "1,154,353"
- P. 1019, L. 24, "Stdlength" should read "strength"
- P. 1026, L. 15, "clean" should read "clean"
- P. 1029, L. 15, "maitained" should read "maintained"
- P. 1032, L. 10, "line" should read "lines"
- P. 1032, L. 22, "Cold" should read "Gold"
- P. 1033, L. 23, "filled" should read "fitted" and "agitation" should read "agitator"
- P. 1034, L. 11, "fihst" should read "first"
- P. " L. 19, "doen" should read "done"
- P. " L. 21, "an dafter" should read "and after"
- P. " L. 25, "aigtators" should read "agitators"
- P. 1036, L. 6, "parcesl" should read "parcels"
- P. 1036, L. 18, "mash" should read "mesh"
- P. 1038, L. 15, "Insoluble 1" should read "Insoluble"
- P. 1040, L. 9, insert "own" before "investj."
- P. 1041, L. 18, "is" should read "in"
- P. 1042, L. 20, "graduation" should read "gradation"
- P. 1043, L. 23, "impossible" should read "possible"
- P. 1048, L. 6, "removed" should read "renewed"
- P. 1049, L. 26, "gallons" should read "gallon"
- P. 1051, L. 19, insert "3" before "dwt"
- P. 1053, L. 24, "recocerable" should read "recoverable"
- P. 1056, L. 22, "Cœnaentartes" should read "Concentrates"
- P. 1058, L. 7, "per-" should read "pre"
- P. 1060, L. 3, "Courtmay" should read "Courtney"
- P. 1063, L. 25, "The" should read "fine"
- P. 1065, L. 10, "The" should read "This"
- P. 1065, L. 11, "tection" should read "tective"
- P. 1068, L. 10, "1914" should read "1904"
- P. 1075, L. 27, "is" should read "it" after "(pamphlet)"
- P. 1077, L. 22, "Dears" should read "Dear"
- P. 1077, L. 24, insert "up" after "work"
- P. 1078, L. 7, insert "following on suggestions from Mr. Cattermole" after "used"
- P. 1079, L. 11, "separation" should read "separations"
- P. 1081, L. 24, "Kilbourn's" should read "Kilburn's"
- P. 1088, L. 12, "(2)" should read "(b)"
- P. 1092, L. 13, "tiontion" should read "tion"
- P. 1092, L. 16, insert "the" before "delinquent"
- P. 1093, L. 4, "contaminate" should read "contaminates"
- P. 1093, L. 12, insert "plant" before "with"
- P. 1095, L. 10, insert "the" before "pulp"
- P. 1109, L. 27, "Not" should read "No"
- P. 1115, L. 32, insert "a" before "considerably"
- P. 1116, L. 13, "maxer" should read "mixer"
- P. 1116, L. 30, insert "froth" before "rises"
- P. 1118, L. 16, "spit-" should read "spitz-"

- P. 1119, L. 23, "clearly" should read "cleanly"
- P. 1124, L. 30, cancel "plan, but" and insert before "plan",
"top plan, but each was brought to a cone
shaped bottom the depth of"
- P. 1125, L. 5, "siutably" should read "suitable"
- P. 1125, L. 16, "outset" should read "outside"
- P. 1125, L. 22, "plaec" should read "place"
- P. 1125, L. 30, "Cleanliness" should read "cleanness"
- P. 1132, L. 24, "analogus" should read "analogous"
- P. 1145, L. 15, "Developments" should read "Development"
- P. 1151, L. 11, "likely" should read "unlikely"
- P. 1151, L. 28, "materials" should read "minerals"
- P. 1152, L. 11, cancel "not"
- P. 1152, L. 21, insert "a" before "richer and richer"
- P. 1153, L. 11, "formnig" should read "forming"
- P. 1158, L. 11, insert "and the partial products were then tabled or
vanned" after "flotation"
- P. 1160, L. 14, insert "results. To the extent that we do better
their" before "results"
- P. 1164, L. 24, "separators" should read "separations"
- P. 1165, L. 4, "elminate" should read "eliminate"
- P. 1167, L. 12, "incerase" should read "increase"
- P. 1168, L. 22, "enabel" should read "enable"
- P. 1180, L. 8, insert "on the market for regulating and controlling
the feed" after "devices"
- P. 1183, L. 19, "S. S." should read "S. C."
- P. 1184, L. 31, insert "valuable mineral; in another a lower ex-
traction of the" before "mineral"
- P. 1186, L. 26, insert "near" before "Ottowa"
- P. 1189, L. 4, "34th" should read "23rd"
- P. 1191, L. 25, insert "your" before "London"
- P. 1192, L. 19, "or" should read "of"
- P. 1193, L. 26, insert "copper situation, the British Columbia" be-
fore "lead"
- P. 1194, L. 9, "those" should read "these"
- P. 1195, L. 32, "Herminia" should read "Hermina"
- P. 1197, L. 9, "calcopryite" should read "chalcopyrite"
- P. 1197, L. 22, insert "an" before "80%"
- P. 1199, L. 7, "available" should read "valuable"
- P. 1206, L. 4, insert "17th January, 1911"
- P. 1206, L. 26, "big" should read "going"
- P. 1208, L. 22, insert "the" before "water"
- P. 1208, L. 23, "small" should read "large"
- P. 1209, L. 21, insert "Suspended matter, the extreme variation
being from 12.3%" before period (.)

P. 1210, erase from lines 16 to p. 1211 line 3 and substitute

POTASH ALUM

Time of Settling.	$\frac{1}{2}\%$	1%	2%	5%
$\frac{1}{2}$ hour.....	99(?)	94	98	95
3 hours.....	99	99	95	96
14 hours.....	100	..	100	
15 hours.....				
20 hours.....				

CaO PRESENT AFTER ADDING LIME WATER.

	.00305%	.00595%	.01136%	.02083%	.02885%	.04167%
$\frac{1}{2}$ hour ..	77	95	98	100	100	95
3 hours..	91	100	100	100	100	98
14 hours..						
15 hours..	100	98	100	100	96	
20 hours..						

P. 1211, L. 7, "0.59%" should read "0.57%"

P. 1211, L. 27, "teh" should read "the"

P. 1214, L. 27, after "Patent" reads "are"

P. 1220, L. 13, "enonomically" should read "economically"

ERRATA.

VOLUME IV.

- P. 1323, L. 22, "advisable" should read "advised"
- P. 1327, L. 12, "Separations" should read "Separation"—omit (,)
- P. 1327, L. 13, insert "or that said Minerals Separation American Syndicate, limited," before "received"
- P. 1332, L. 9, insert "of said letters patent or has continued such infringement" before "after"
- P. 1333, L. 21, insert "now" before "able"
- P. 1334, L. 5, "was" should read "were"
- P. 1335, L. 2, insert "and" before "substantial"
- P. 1338, L. 14, "589,070" should read "689,070" and "February" should read "December"
- P. 1339, L. 16, insert "deposited and filed" before "by"
- P. 1341, L. 7, insert after "No.," "777,274 were granted thereon upon December 13, 1904. Arthur E. Cattermole, Henry L. Sulman and Hugh F. Kirkpatrick-Picard, all residents of London, England, on March 29, 1904, deposited and filed in the United States Patent Office their application for letters patent of the United States, and that letters patent No."
- P. 1341, L. 19, change "graned" to "granted"
- P. 1342, L. 4, cancel "after" "1906"
- P. 1345, L. 23, insert "of" before "eight"
- P. 1346, L. 25, "weight" should read "weigh"
- P. 1352, L. 28, "understood" should read "understand"
- P. 1357, L. 14, insert "69" before "Now"
- P. 1359, L. 26, insert "89" before "When"
- P. 1360, L. 5, insert "oil" before "was"
- P. 1360, L. 15, insert "93" before "Then"
- P. 1361, L. 6, "R." should read "A."
- P. 1362, L. 3, cancel whole line and insert, "Only one"
- P. 1364, After L. 13, insert "A. One."
- P. 1369, L. 22, insert "164th" before "Now."
- P. 1369, L. 28, "examinated" should read "examination"
- P. 1373, L. 15, "of" should read "for"
- P. 1374, L. 15, "part" should read "parts"
- P. 1375, L. 8, "Mineral" should read "Minerals" and "Separations" should read "Separation"
- P. 1376, L. 24, "large" should read "larger"
- P. 1381, L. 6, insert "water. A second method is by attachment of these mineral particles around gas bubbles which float upon" after "upon".
- P. 1404, L. 4, insert "of" before "cleaned"
- P. 1404, L. 30, "fel-" should read "feld"
- P. 1416, L. 25, "Ballott" should read "Ballot"
- P. 1421, L. 10, "oriignal" should read "original"

- P. 1429, L. 25, " was " should read " were "
- P. 1434, L. 17, insert " being " before " fine "
- P. 1441, L. 3, insert " for repair and the very frequent shut-downs " after " shut-downs "
- P. 1442, L. 15, insert " to " before " for "
- P. 1444, L. 16, " volumne " should read " volume "
- P. 1445, L. 20, " T. H. Hoover " should read " T. J. Hoover "
- P. 1446, L. 29, " me " should read " for one "
- P. 1451, L. 20, " Centrigrade " should read " Centigrade "
- P. 1451, L. 21, " appearances " should read " appearance "
- P. 1451, L. 25, " Centrigrade " should read " Centigrade "
- P. 1457, L. 4, " ules " should read " ues "
- P. 1457, L. 14, " mixor " should read " mixer "
- P. 1473, L. 4, " reasons " should read " reason "
- P. 1473, L. 22, " 2627," should read " 26, 27,"
- P. 1476, L. 31, " olei cacid " should read " oleic acid "
- P. 1479, L. 3, " dliute " should read " dilute "
- P. 1494, L. 13, " insert " to " before " themselves "
- P. 1500, L. 13, " floating " should read " flowing "
- P. 1501, L. 20, " tnued " should read " inued "
- P. 1505, L. 5, " being " should read " using "
- P. 1505, L. 21, " ore " should read " ores "
- P. 1507, L. 15, " ore " should read " ores "
- P. 1520, L. 25, insert " carbon " before " dioxid "
- P. 1525, L. 24, " sa " should read " as "
- P. 1531, L. 20, " sum " should read " scum "
- P. 1532, L. 4, " iztd " should read " ized "
- P. 1532, L. 23, " mateured " should read " matured "
- P. 1539, L. 15, " incoemptent " should read " incompetent "
- P. 1547, L. 27, " 50 " should read " 30 "
- P. 1552, L. 19, insert quotation mark (") before " fraction "
- P. 1558, L. 28, " oriignal " should read " original "
- P. 1556, L. 3, " raito " should read " ratio "
- P. 1568, L. 22, change " 735.381 " to " 735,071 "
- P. 1577, L. 21, " electro-" should read " electro "
- P. 1578, L. 6, " electrochemically " should read " electrolytically "
- P. 1581, L. 20, insert " and bubbles of air or gas in this body of ore-pulp " before , " what "
- P. 1587, L. 28, " patent " should read " patents "
- P. 1604, L. 7, cancel " the "
- P. 1613, L. 19, " the final " should read " these final "
- P. 1618, L. 5, " Picard " should read " Higgins "
- P. 1622, L. 20, " serve " should read " serves "
- P. 1624, L. 15, " Ballentyne " should read " Ballantyne "
- P. 1627, L. 18, cancel " the " before " fine "
- P. 1632, L. 31, cancel " accompanying "
- P. 1635, L. 16, insert " ever " before " occur "
- P. 1641, L. 11, " amount " should read " amounts "
- P. 1642, L. 19, " dripping " should read " dropping "
- P. 1651, L. 26, " the " should read " this "
- P. 1653, L. 9, " taind " should read " tain "

- P. 1656, L. 7, "out" should read "up"
- P. 1656, L. 17, insert "to" before "entrap"
- P. 1657, L. 23, "where" should read "were"
- P. 1666, L. 11, insert "the central tube and out at the top, so forming a circuit" before "in"
- P. 1667, L. 5, insert "Boulton," before "Haywood"
- P. 1669, L. 8, "10," should read "19,"
- P. 1672, L. 20, "together" should read "altogether"
- P. 1676, after L. 12, insert "was formed in which oil, water, mineral and gaugue were contained as a "mush" some of this material"
- P. 1677, L. 18, "783" should read "7803"
- P. 1677, L. 24, "laboratoory" should read "laboratory"
- P. 1678, L. 27, "of" should read "oil"
- P. 1682, L. 22, insert "in" before "that answer"
- P. 1682, L. 25, "contomitantly" should read "concomitantly"
- P. 1684, L. 3, cancel "was"
- P. 1686, L. 29, "effecting" should read "affecting"
- P. 1688, L. 7, "reported" should read "report"
- P. 1690, L. 22, "type" should read "types"
- P. 1695, L. 30, insert "badly" after "frequently"
- P. 1698, L. 27, "piror" should read "prior"
- P. 1699, L. 25, "certanily" should read "certainly"
- P. 1700, L. 15, "introduceian" should read "introduction"
- P. 1709, after L. 2, insert "Drawing," and the small drawing as "Froment"
- P. 1709, L. 17, cancel "for it"
- P. 1717, L. 21, "Higgins" should read "Higgins' "
- P. 1727, L. 11-14, cancel from "Guided by" to "or not"
- P. 1734, L. 25, "constitued" should read "constituted"
- P. 1736, L. 22, "large" should read "larger"
- P. 1738, L. 9, "tious" should read "tors"
- P. 1739, L. 7, "relations" should read "relation"
- P. 1742, L. 29, "reefreence" should read "reference"
- P. 1743, L. 23, "sirring" should read "stirring"
- P. 1744, L. 4, insert "flotation process and the Sulman and Picard" before "process"
- P. 1744, L. 14, insert "type or the Sulman and Picard's bubble type of" before "process"
- P. 1744, L. 15, "gass" should read "gas"
- P. 1746, L. 11, insert "more" before "spitzkasten"
- P. 1755, L. 18, insert "crushed" before "dry"
- P. 1758, L. 14, insert "so as to reach down on the inside of the mixing vessel" before "well"
- P. 1765, L. 11, cancel "last"
- P. 1766, L. 12, insert "then" before "both"
- P. 1771, L. 14, "Milan" should read "Turin"
- P. 1771, L. 27, "Milau" should read "Turin"
- P. 1772, L. 7, "Milau" should read "Turin"
- P. 1772, L. 8, "Milan" should read "Turin"
- P. 1775, L. 16, insert "as" before "to which"

- P. 1795, L. 18, "fattey" should read "fatty"
- P. 1798, L. 6, "aluminm" should read "aluminum"
- P. 1798, L. 9, "ulaces" should read "places"
- P. 1801, Ll. 19-21, cancel.
- P. 1801, L. 30, "R" should read "A"
- P. 1802, L. 21, "iriginal" should read "original"
- P. 1812, L. 17, "17" should read "117"
- P. 1819, L. 9, insert "in" before "these"
- P. 1828, L. 29, "my" should read "may"
- P. 1830, L. 17, insert "Fitzalis" before "KirkPatrick-Picard"
- P. 1833, L. 11, "clearly" should read "closely"
- P. 1853, L. 21, "other gas current by the use of any suitable spraying or" insert before "atomizing"
- P. 1854, L. 23, "intsances" should read "instances"
- P. 1855, L. 19, "was" should read "with"
- P. 1855, L. 29, "dessiminating" should read "disseminating"
- P. 1856, L. 19, "and" should read "that" after colon (:)
- P. 1857, L. 3, "represetnatives" should read "representatives"
- P. 1866, L. 26, "widley" should read "wideiy"
- P. 1883, L. 10, "Chie" should read "Chief"
- P. 1886, L. 10, "persented" should read "presented"
- P. 1886, L. 16, "admis" should read "admix"
- P. 1890, L. 8, insert "then treating the resulting metallic sulfid" before "with a"
- P. 1890, L. 14, insert "same to the action of a soluble sulfid then treating the" before "resulting"
- P. 1895, L. 11, insert "or on an application for a patent filed in any country foreign to the United States by him or his legal representatives or assigns more than twelve months prior to the filing of said application" before "and that"
- P. 1902, after last line insert "Patented December 19, 1905"
- P. 1904, L. 19, "or" should read "of"
- P. 1905, L. 11, "matter" should read "material"
- P. 1905, L. 14, insert "condition" before "during"
- P. 1905, L. 27, insert "into intimate contact with all portions of the ore. The Vessel may be steam jacketed, or otherwise suitably heated, if found necessary to maintain the selective material," after "material"
- P. 1906, L. 5, "moved" should read "removed"
- P. 1911, L. 21, "claims" should read "case as follows"
- P. 1914, L. 3, "Tchirner" should read "Tschirner"
- P. 1931, L. 12, "section" should read "sectional"
- P. 1934, L. 15, "of" should read "for" after "solution"
- P. 1934, L. 23, "covered" should read "moved"
- P. 1935, L. 21, "mash" should read "marsh"
- P. 1940, L. 12, insert "result" before "is"
- P. 1943, L. 18, insert "furnace" before "H."
- P. 1944, L. 9, insert "kept" before "filled"

- P. 1945, L. 26, insert " gently agitating the portion thereof which settles, and in " after " in "
- P. 1947, Ll. 23-25, cancel from " into fine " to " solution "
- P. 1948, L. 6, insert " to " after " in "
- P. 1949, L. 24, insert " in " before " sep- "
- P. 1950, L. 29, insert " or in public use or on sale in the United States for more than two years prior to this application " after colon (:)
- P. 1953, L. 6, cancel " in " before " invention "
- P. 1954, L. 7, " paentable " should read " patentable "
- P. 1956, L. 26, " perosene " should read " kerosene "
- P. 1960, L. 15, " 726,609 " should read " 725,609 "
- P. 1963, L. 17, cancel " any " before " chance "
- P. 1964, L. 11, " gentling " should read " gently "
- P. 1977, Ll. 28 & 29, cancel " of the surface "
- P. 1981, transpose lines 17 and 18
- P. 1991, L. 3, " proceedure " should read " procedure "
- P. 1992, L. 13, " f led " should read " filed "
- P. 1995, L. 9, " g " should read " g' "
- P. 2000, L. 3, " or " should read " of "
- P. 2004, L. 22, " Jaune " should read " June "
- P. 2009, L. 8, " Sulma " should read " Sulman "
- P. 2010, L. 9, " No." should read " Nov. "
- P. 2013, L. 20, " Mial " should read " Mail "
- P. 2017, L. 22, insert " so " before " used "
- P. 2018, L. 14, " aperatures " should read " apertures "
- P. 2019, L. 19, " a " should read " r "
- P. 2019, L. 26, " ? " should read " . "
- P. 2021, L. 26, " rotable " should read " rotatable "
- P. 2023, L. 3, " rotale " should read " rotatable "
- P. 2023, L. 19, insert " a " before " submerged "
- P. 2032, L. 15, " Celveland " should read " Cleveland "
- P. 2046, L. 24, " 487 " should read " 4897 "

ERRATA.

VOLUME V.

- P. 2197, L. 1, "Circuit" should read "District"
- P. 2197, L. 4, cancel "Company" after "Separation"
- P. 2200, L. 17, "motion" should read "objection"
- P. 2210, L. 2, cancel before "Why"
- P. 2210, L. 8, "equivalent" should read "equivalents"
- P. 2210, L. 9, cancel after "them"
- P. 2211, L. 4, insert after "claims", "*res adjudicata*, and will try to prove it, the plaintiff claims"
- P. 2216, L. 22, insert after "true", "and"
- P. 2220, L. 20, "9615" should read "96;15"
- P. 2222, L. 10, cancel "both"
- P. 2222, L. 27, "tures" should read "ture"
- P. 2224, L. 1, "court" should read "Court"
- P. 2224, L. 10, cancel "the"
- P. 2226, L. 21, "forefiture" should read "forfeiture"
- P. 2227, L. 31, cancel the period (.) after "sonable"
- P. 2228, L. 14, "certorari" should read "certiorari."
- P. 2233, L. 20, cancel "and keep"
- P. 2234, L. 16, "Romacka" should read "Romadka"
- P. 2237, L. 12, insert after "core", "and limit to the forming of the roll with the core"
- P. 2238, L. 24, insert "Court", after "Supreme"
- P. 2238, L. 25, "218221" should read "218,221"
- P. 2239, L. 10, cancel "say"
- P. 2243, L. 10, "elecrolytic" should read "electrolytic"
- P. 2250, L. 3, "mistaking" should read "mistakes"
- P. 2251, L. 15, "1892" should read "1912"
- P. 2255, L. 15, "question" should read "case"
- P. 2256, L. 6, "road" should read "broad"
- P. 2275, L. 4, "comity" should read "priority"
- P. 2276, L. 2, "stipultoin" should read "stipulation"
- P. 2277, L. 21, "sufficient" should read "insufficient"
- P. 2277, L. 24, "Lime" should read "Line" and "Jacobson", should read "Jacobsen"
- P. 2278, L. 10, insert "with", after "contact"
- P. 2278, L. 21, "waive" should read "raise"
- P. 2282, L. 14, "that" should read "it"
- P. 2283, L. 23, "KREMER" should read "GARRISON"
- P. 2285, L. 9, insert "or the benefit of the knowledge of James M. Hyde" after "Hyde"
- P. 2287, L. 32, "a cross" should read "across" and insert "the" after "across"
- P. 2288, L. 12, "Kramer" should read "Kremer"
- P. 2295, L. 8, cancel "not"
- P. 2297, after L. 27, insert, "Letter dated July 2, 1913, admitted in evidence and marked Plaintiff's Exhibit No. 5."
- P. 2300, L. 24, "argumenting" should read "augmenting"

- P. 2301, L. 1, "Mineral" should read "Minerals"
- P. 2301, L. 2, "arations" should read "aration"
- P. 2302, L. 20, "ony" should read "any"
- P. 2304, L. 21, "1915" should read "1913"
- P. 2305, L. 17, insert "proceedings" after "following"
- P. 2306, L. 5, "separting" should read "separating"
- P. 2312, L. 16, cancel "X"
- P. 2318, L. 25, "eral" should read "erals"
- P. 2321, L. 11, insert "to", after "object"
- P. 2325, L. 21, "flotations" should read "flotation"
- P. 2332, L. 27, "object" should read "objection"
- P. 2339, L. 11, "that" should read "what"
- P. 2345, L. 11, "X" should read "R"
- P. 2345, L. 14, "X" should read "R"
- P. 2345, L. 16, "X" should read "R"
- P. 2349, L. 10, cancel "admitted"
- P. 2350, L. 17, cancel "Company"
- P. 2351, L. 15, "or" should read "on"
- P. 2360, L. 21, "persentations" should read "presentations"
- P. 2367, L. 31, "becaues" should read "because"
- P. 2368, L. 14, "Leipmann" should read "Leibmann"
- P. 2369, L. 8, "Leipmann" should read "Leibmann"
- P. 2378, L. 17, "licensee" should read "licensees"
- P. 2381, L. 24, insert "32" after "Q."
- P. 2383, L. 7, "20th" should read "30th"
- P. 2384, L. 1, "Frank B." should read "Frank R."
- P. 2384, L. 24, "Frank B." should read "Frank R."
- P. 2385, L. 1, "Frank B." should read "Frank R."
- P. 2586, L. 1, "Frank B." should read "Frank R."
- P. 2389, L. 28, "invenion" should read "invention"
- P. 2397, L. 21, "doctrine" should read "decision"
- P. 2403, L. 6, "frequently" should read "properly"
- P. 2407, L. 24, "ecsses" should read "cesses"
- P. 2408, L. 19, "Procter" should be "Proctor"
- P. 2417, L. 24, cancel "What" and "was" should read "Was"
- P. 2421, L. 3, "Hurly" should read "Hurley"
- P. 2431, L. 2, "concenient" should read "convenient"
- P. 2434, L. 9, "forth" should read "froth"
- P. 2437, L. 11, "Janey" should read "Janney"
- P. 2441, L. 8, "tweill" should read "twill"
- P. 2442, L. 18, cancel "the" after "over"
- P. 2448, L. 17, "contitute" should read "constitutes"
- P. 2465, L. 25, insert "much" after "pretty"
- P. 2467, After L. 10, insert "A. I had supervision over them, yes sir."
- P. 2472, L. 24, insert "x-Q. 254½" after "WILLIAMS."
- P. 2474, L. 2, insert "us" after "give"
- P. 2477, L. 7, "25" should read "20"
- P. 2479, L. 5, cancel "there"
- P. 2479, L. 8, "279" should read "297"
- P. 2492, L. 13, "394" should read "384"

- P. 2496, After L. 5, insert "A. Yes, Sir."
- P. 2496, L. 26, insert "this day's operation was selected for the purpose of" before "this"
- P. 2499, L. 17, "kind" should read "kinds"
- P. 2501, L. 26, "figures" should read "figure"
- P. 2505, L. 17, insert "or systematic sampling, and systematic determination" after "tion"
- P. 2506, L. 8, "other" should read "ether"
- P. 2508, L. 3, "enedavored" should read "endeavored"
- P. 2516, L. 16, "546" should read "544"
- P. 2525, L. 4, "palnts" should read "plants"
- P. 2525, L. 17, "calculaters" should read "calculators"
- P. 2525, L. 26, "calcuclation" should read "calculation"
- P. 2526, L. 27, "laboratoory" should read "laboratory"
- P. 2530, L. 20, "apparatus" should read "aperture"
- P. 2530, L. 21, "aperature" should read "aperture"
- P. 2537, L. 23, cancel "ON" and "VOIRE" should read "VOIR"
- P. 2542, L. 20, "5" should read "3."
- P. 2543, L. 5, "1916" should read "1915"
- P. 2561, L. 5, "test" should read "tests"
- P. 2564, L. 5, "92" should read "91"
- P. 2567, L. 2, "proporties" should read "properties"
- P. 2567, L. 7, "dure" should read "duce"
- P. 2570, L. 26, "Sall" should read "Ball"
- P. 2572, L. 20, "execllent" should read "excellent"
- P. 2576, L. 9, "pin" should read "pine"
- P. 2584, L. 10, "samples" should read "sample" and "were" should read "was"
- P. 2588, L. 30, cancel "of the". "issue" should read "issued"
- P. 2593, L. 30 & 31, erase from "and" to and including "phenol"
- P. 2597, L. 15, insert "time" after "the"
- P. 2606, L. 8, "it" should read "is"
- P. 2607, L. 2, "303" should read "313"
- P. 2607, L. 19, insert "317" after "Q."
- P. 2611, L. 12, "palnt" should read "plant"
- P. 2614, L. 23, "231" should read "341"
- P. 2616, L. 6, "42" should read "242"
- P. 2617, After L. 17, insert "x-Q. 383. You said you added 1.60 oil to that, didn't you? A. Yes, sir."
- P. 2617, L. 29, insert "that they are large enough so that if you would analyze" after "sure"
- P. 2619, L. 13, "out" should read "about"
- P. 2628, After L. 22, insert "R-X-Q. 443. The Dorr thickener -was not known to you when you began the next twenty four run?"
- P. 2629, L. 17, "Mangna" should read "Magna"
- P. 2653, L. 20, insert "from these return cells which to make up the circulating load contains a certain amount of oil, the froth" after "froth"
- P. 2656, L. 18, "waws" should read "was"
- P. 2657, L. 3, "97,687" should read "97.887"

- P. 2660, L. 10, " thorough " should read " through "
- P. 2672, L. 3, " two " should read " to "
- P. 2672, L. 11, " as " should read " a "
- P. 2689, L. 19, " 1913 " should read " 1915 "
- P. 2703, L. 22, cancel " that "
- P. 2704, L. 13, " to " should read " of "
- P. 2704, L. 28, " that's " should read " that is "
- P. 2710, L. 12, insert " and from the spitzkastens " after " Spitzkastens "
- P. 2711, L. 6, " maerial " should read " material "
- P. 2712, L. 19, " we " should read " was "
- P. 2715, L. 14, cancel " which "
- P. 2716, L. 10, " an " should read " and "
- P. 2719, After L. 28, insert " A. (interrupting) per day. I don't remember I "
- P. 2720, L. 5, cancel.
- P. 2723, L. 6, " least " should read " last "
- P. 2726, L. 4, " propotrion " should read " proportion "
- P. 2734, L. 4, " for " should read " forth "
- P. 2739, L. 24, " Compelled " should read " compiled "
- P. 2742, L. 21, " thorough " should read " through "
- P. 2743, L. 21, " feet " should read " holes "
- P. 2743, L. 23, " feet " should read " holes "
- P. 2745, L. 7, " informatian " should read " information "
- P. 2759, L. 13, " ope rtion " should read " operation "
- P. 2760, L. 7, insert " I " after " aud "
- P. 2762, L. 25, " GARRISON " should read " KREMER "
- P. 2763, L. 9, bookkeepepr " should read " bookkeeper "
- P. 2764, L. 5, " falacious " should read " fallacious "
- P. 2773, L. 18, erase " as not " and insert " that he will " and erase " him " after " have " and insert " to "
- P. 2785, L. 4, " 77 " should read " 79 "
- P. 2787, L. 3, erase " case " and insert " page "
- P. 2787, L. 15, " 1899 " should read " 1889 "
- P. 2788, L. 21, " disclosed " should read " discussed "
- P. 2791, L. 15, insert " any " after " with "; L. 27, erase " 5 "
- P. 2798, L. 24, " oil " should read " ore " after " thin "
- P. 2804, L. 19, " gress " should read " greens "
- P. 2807, L. 10, " 22." should read " 32."
- P. 2813, L. 14, " uesd " should read " used "
- P. 2813, L. 23, " sulphite " should read " sulphide "
- P. 2816, L. 7, " produied " should read " produced "
- P. 2821, L. 13, " leaves a " should read " leads the "
- P. 2837, L. 6, " differenece " should read " difference "
- P. 2837, L. 17, " forth " should read " froth "
- P. 2844, L. 17, " parrafine " should read " paraffine "
- P. 2850, L. 12, " J² " should read " D² "
- P. 2850, L. 26, " cecond " should read " second "
- P. 2851, L. 24, " Floatant " should read " Flotant "
- P. 2859, L. 3, insert " and refer to the great chemist of the sixteenth century " after " Century "
- P. 2863, L. 10, " subtsance " should read " substance "

- P. 3034, L. 15, " a gain " should read " again "
- P. 3036, L. 3, insert " to offer " before " them "
- P. 3036, L. 7, " graps " should read " graphs "
- P. 3036, L. 25, " or " should read " on "
- P. 3039, L. 17, " Considering " should read " Consider "
- P. 3039, L. 19, cancel " a "
- P. 3039, L. 20, " force " should read " forces "
- B. 3041, L. 19, " is " should read " in "
- P. 3041, L. 30, " surface " should read " surfaces "
- P. 3043, L. 24, insert " the " after " in "
- P. 3050, L. 30, cancel " of " after " soap "
- P. 3053, L. 14, " perimetnal " should read " perimental "
- P. 3053, L. 24, " soild " should read " solid "
- P. 3057, L. 25, insert " again " after " plates "
- P. 3058, L. 12, " w " should read " d "
- P. 3059, L. 9, " binding " should read " bending "
- P. 3059, L. 22, insert " water, and on the water side it contains
some particles of " after " of "
- P. 3060, L. 2, " sir " should read " air "
- P. 3060, L. 13, " olwer " should read " lower "
- P. 3062, L. 17, " bornzing " should read " bronzing "
- P. 3066, After L. 31, insert " A. No. "
- P. 3073, L. 19, " subtsances " should read " substances "
- P. 3074, L. 14, " is " should read " if "
- P. 3076, L. 26, " tempearture " should read " temperature "
- P. 3082, L. 3, " phenomena " should read " phenomenon "
- P. 3083, L. 11, " perssed " should read " pressed "
- P. 3089, L. 15, " as " should read " has "—" for " should read " of "
- P. 2090, L. 26, " 140 " should read " 14C "
- P. 3090, L. 27, " cr " should read " of "
- P. 3092, L. 15, " or " should read " of "
- P. 3092, L. 29, " absorberd " should read " adsorberd "
- P. 3099, L. 8, " disturbanes " should read " disturbance "
- P. 3099, L. 14, " absorberd " should read " adsorberd "
- P. 3100, L. 25, insert " at the inside of the bubble, and at the
metal oil surface " after " surface "
- P. 3101, L. 16, " absorpition " should read " adsorption "
- P. 3105, L. 14, " minnum " should read " minimum "
- P. 3109, L. 13, " is it " should read " it is "
- P. 3110, L. 20, " understood " should read " understood "
- P. 3115, L. 7, " exery " should read " every "
- P. 3115, L. 9, cancel " over every bubble " and insert " of oil
might attach itself to the ore molecule of " after
" molecule "
- P. 3117, L. 15, " difference " should read " differences "
- P. 3120, L. 16, " tnesion " should read " tension "
- P. 3120, L. 24, insert " your " after " get "
- P. 3124, L. 2, " form " should read " perform "
- P. 3124, L. 9, " ore " should read " air "
- P. 3129, L. 8, " force " should read " forces "
- P. 3129, L. 29, " stock " should read " stick "

- P. 3130, L. 27, "or" should read "of"
- P. 3132, L. 6, "that" should read "what"
- P. 3133, L. 7, "Strasberg" should read "Strasburg"
- P. 3133, L. 9, "Leipsiz" should read "Leipsig"
- P. 3133, L. 10, "by" should read "my"
- P. 3133, L. 19, "Cookke's" should read "Cooke's"
- P. 3137, L. 7, "might" should read "must"
- P. 3141, L. 23 "cohoool" should read "cohol"
- P. 3142, L. 15, "solution" should read "solutions"
- P. 3143, L. 17, "causes" should read "cases"
- P. 3145, L. 17, "insoluble" should read "soluble"
- P. 3145, L. 30, "absorption" should read "adsorption"
- P. 3147, L. 16, "absorption" should read "adsorption"
- P. 3147, L. 26, cancel "oils" and insert "practically insoluble oils and range" after "with"; cancel "and change"
- P. 3150, L. 22, insert "first that water and pine oil when stirred give no permanent froth. There is a temporary froth but no permanent one. We showed" after "showed"
- P. 3151, L. 10, "sconds" should read "seconds"
- P. 3158, L. 20, "nor" should read "or"
- P. 3161, L. 16, cancel "like"
- P. 3161, L. 15, insert "again" after "looks"
- P. 3162, L. 25, insert "it" after "at"
- P. 3163, L. 25, "absoltuely" should read "absolutely"
- P. 3178, L. 4, "increase" should read "increases"
- P. 3182, L. 21, "got" should read "get"
- P. 3185, L. 16, "we" should read "We"
- P. 3189, L. 11, insert "recovery and" after "100%"
- P. 3192, L. 2, "a" should read "of"
- P. 3193, L. 13, insert "either" after "theory"
- P. 3196, L. 20, "tension" should read "tensions"
- P. 3197 L. 7, "slow" should read "low"
- P. 3198, L. 27, "then" should read "that"
- P. 3199, L. 5, insert "not" after "generally"
- P. 3199, L. 6, "and which use the" should read "so it is a"
- P. 3199, L. 31, insert "all" after "they"
- P. 3200, L. 9, "139" should read "130"
- P. 3202, L. 26, insert "first" before "on"
- P. 3205, L. 26, "second" should read "minute"
- P. 3206, L. 21, cancel "of"
- P. 3211, L. 13, insert " "as an oil", and wherever he repeats it he always says", after (:)
- P. 3212, L. 26, "er" should read "or"
- P. 3214, L. 19, insert "to eat" after "got"
- P. 3215, after L. 9, insert "A. Yes."
- P. 3215, L. 10, insert "force," after "a"
- P. 3215, L. 11, insert "would" before "it" and cancel "or the result of the"
- P. 3215, L. 16, "forec" should read "force"

- P. 3217, L. 10, " of " should read " or "
- P. 3217, L. 21, insert " a " after " to "
- P. 3220, L. 2, " storage " should read " range "
- P. 3221, L. 8, " Capillar " should read " Kapillar "
- P. 3223, L. 2, " liquifies " should read " liquefies "
- P. 3223, L. 25, " Wilbut " should read " Wilder "
- P. 3226, L. 14, " MacQuistion " should read " MacQuisten "
- P. 3228, L. 27, " suposed " should read " supposed "
- P. 3229, L. 22, erase colon (:) after " surface "
- P. 3237, L. 16, " Circulation " should read " Circulating "
- P. 3238, L. 13, insert " that " after " before "
- P. 3240, L. 18, " uopn " should read " upon "
- P. 3243, L. 17, " 1917 " should read " 1914 "
- P. 3246, L. 12, " regular " should read " rougher "
- P. 3250, L. 3, insert " these go through 15 more in multiple, and the tailings from " after " from "
- P. 3259, L. 7, insert " of " after " year " and " yea " should read " year "
- P. 3263, L. 23, " and " should read " the "
- P. 3265, L. 4, " tailings " should read " tailing "
- P. 3265, L. 27, insert " roughers, and then followed by another set of five as " after " as "
- P. 3266, L. 4, " date " should read " data "
- P. 3266, L. 5, " operations " should read " operation "
- P. 3268, L. 24, insert " Take the run of February 8th to 28th in this same plant." after " ton "
- P. 3271, L. 12, " concentration " should read " concentrate "
- P. 3272, L. 8, " an " should read " a "
- P. 3278, L. 22, " charge " should read " change "
- P. 3285, L. 19, " this " should read " these "
- P. 3291, L. 12, " froth " should read " from "
- P. 3295, L. 12, " ail " should read " oil "
- P. 3299, L. 21, " 6.69 " should read " 6.69 "
- P. 3300, L. 6, " resutling " should read " resulting "
- P. 3315, L. 29, insert " of," erase " a "
- P. 3311, L. 15, " Kremer " should read " Kenyon "
- P. 3311, L. 30, " complaint " should read " complainant "
- P. 3312, L. 25, " complaint " should read " complainant "
- P. 3315, D. 8, erase comma (,) after " tion "
- P. 3315, L. 13, erase comma (,) after " tion "
- P. 3316, L. 19, erase comma (,) after " Separation "
- P. 3316, L. 21, " " " " " "
- P. 3316, L. 26, erase (,) after " Separation "
- P. 3317, L. 10, erase (,) after " Separation " and " required " should read " acquired ",
- P. 3317, L. 27, " defendant " should read " defence "
- P. 3318, L. 8, " Ballott " should read " Ballot "
- P. 3318, L. 21, cancel " been "
- P. 3318, L. 28, erase comma (,) after " Separation "
- P. 3323, L. 6, " his " should read " this "

- P. 3324, L. 19, erase comma (,) after " Separation "
- P. 3324, L. 20, " " " " " "
- P. 3327, L. 21, insert " is " after " this "
- P. 3329, L. 28, " niecessary " should read " necessary "
- P. 3330, L. 30, cancel " had " after " period "
- P. 3331, L. 3, insert " any " after " right of "
- P. 3331, L. 18, insert " concerned the only excuse offered for this amendment is " after " is "
- P. 3338, L. 8, " hydrulic " should read " hydraulic "
- P. 3338, L. 18, " forths " should read " froths "
- P. 3342, L. 26, insert " the " after " his "
- P. 3350, L. 25, " sulphide " should read " sulphuric "
- P. 3353, L. 8, " alrge " should read " large "
- P. 3355, L. 10, " 02 " should read " 0.2 "
- P. 3365, L. 24, " resutls " should read " results "
- P. 3366, L. 25, " giong " should read " going "
- P. 3370, L. 21, " sluge " should read " sludge "
- P. 3370, L. 26, insert " and " after " Ore "
- P. 3380, L. 7, " acte " should read " cate "
- P. 3380, L. 18, " 63.3 " should read " 63.03 "
- P. 3384, L. 2, " weignts " should read " weights "
- P. 3384, L. 6, " concentates " should read " concentrates "
- P. 3387, L. 7, " wil " should read " will "
- P. 3389, L. 8, " aplies " should read " applies "
- P. 3390, L. 13, " to " should read " in "
- P. 3390, After L. 21, insert " A. It did. "
- P. 3394, L. 2, " interferring " should read " interfering "
- P. 3395, L. 6, insert " 20 " after " tional "
- P. 3401, L. 27, " ide " should read " ic "
- P. 3402, L. 19, " mineral " should read " material "
- P. 3403, L. 2, " + " should read " — " before " 200 mesh, 61.04 "
- P. 3406, L. 16, " 49.05 " should read " 49.5 "
- P. 3407, L. 25, " not " should read " be "
- P. 3411, L. 19, " to " should read " so "
- P. 3412, L. 20, " bubbles " should read " bubble "
- P. 3416, L. 3, " 376,000 " should read " 375,000 "
- P. 3416, L. 15, " froths " should read " froth "
- P. 3418, L. 2, " percentages " should read " percentage "
- P. 3421, L. 27, " mgnification " should read " magnification "
- P. 3423, L. 3, " $1\frac{1}{4}\%$ " should read " $1\frac{1}{2}\%$ "
- P. 3424, L. 31, cancel " with this "
- P. 3427, L. 12, " Williams " should read " Phillips "
- P. 3430, L. 22, " chalco-pyrite " should read " chalcopyrite "
- P. 3431, L. 3, " " " " " "
- P. 3431, L. 16, " The " should read " That "
- P. 3432, L. 11, " Williams " should read " Phillips "
- P. 3434, L. 26, " 1.15 " should read " 1.5 "
- P. 3436, L. 8, " of " should read " or "
- P. 3444, L. 24, " 1913 " should read " 1916 "
- P. 3448, L. 28, " 1.38 " should read 1.35 "
- P. 3452, L. 12, " indefinite " should read " indefinite "

- P. 3453, L. 29, insert " made " after " changes "
- P. 3459, L. 10, " shold " should read " should "
- P. 3462, L. 23, " residum " should read " residuum "
- P. 3469, L. 6, insert " quantity " after " smaller "
- P. 3472, L. 25, " was " should read " were "
- P. 3477, L. 6, " becaues " should read " because "
- P. 3479, L. 28, " by " should read " in "
- P. 3480, L. 25, " seems " should read " scemed "
- P. 3481, L. 16, " bezine " should read " benzine "
- P. 3481, L. 25, " colmn " should read " column "
- P. 3490, L. 17, " cosite " should read " cocite "; L. 19, change
" chalcosite " to " chalcocite "
- P. 3492, L. 13, " other " should read " others "
- P. 3493, L. 4, insert " X " before " Q "
- P. 3495, L. 6, " our " should read " the " and " palnts " should
read " plants "
- P. 3496, L. 9, " deapartment " should read " department "
- P. 3497, L. 5, " or " should read " for "
- P. 3499, L. 19, " Theer " should read " There "
- P. 3519, L. 17, " thou " should read " that "
- P. 3520, L. 6, " degree " should read " figure "
- P. 3525, L. 11, " Barret " should read " Barrett "
- P. 3525, L. 18, " if " should read " of "
- P. 3525, L. 28, cancel " that doesn't "
- P. 3531, L. 4, " emperical " should read " empirical "
- P. 3531, L. 9, insert " familiar to all of us and which are " after
" are "
- P. 3534, L. 25, " the " should read " that " after " at "
- P. 3537, L. 15, " pass " should read " plot "
- P. 3537, L. 16, " blot " should read " plot "
- P. 3539, L. 14, " Q " should read " Y "
- P. 3539, L. 28 and 29, cancel from " but " to and including " dilu-
tion "
- P. 3540, L. 20, " some " should read " more "

ERRATA.

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- P. 3541, L. 3, erase " and." after " age."
- P. 3543, L. 12, " the same the percentage of water in the feed ;
and " after " are "
- P. 3543, L. 14, insert " the pounds of oil per ton of feed and that
the same variation as before holds, namely,"
after " namely,"
- P. 3549, L. 2, " Is " should read " It "
- P. 3549, L. 19, " date " should read " data "
- P. 3549, L. 26, " efficiency " should read " efficient "
- P. 3552, L. 13, " vaner " should read " vanner "
- P. 3553, L. 9, " computation " should read " computation "
- P. 3553, L. 29, " represenatives " should read " representatives "
- P. 3554, L. 8, " recally " should read " really "
- P. 3554, L. 21, " tihs " should read " this "
- P. 3556, L. 10, insert " very " after " were "
- P. 3556, L. 31, " represents " should read " represented "
- P. 3559, L. 4, " simple " should read " sample "
- P. 3560, L. 19, " insert " such " after " test "
- P. 3560, L. 20, " witnesses " should read " witness "
- P. 3561, L. 21, " these " should read " those "
- P. 3563, L. 11, " of " should read " if "
- P. 3565, L. 8, insert " do " after " or "
- P. 3576, LL. 20 & 21, cancel from " you " to and including " some-
what "
- P. 3577, L. 23, " found " should read " bound "
- P. 3578, L. 26, " genelman " should read " gentlemen "
- P. 3578, L. 27, insert " everything " after " omitted "
- P. 3584, LL. 10 & 11, cancel both lines.
- P. 3584, L. 12, insert " not " after " can "
- P. 3584, L. 28, insert " rather than one of scientific technical oper-
ation " after " operation."
- P. 3589, L. 10, " 128 " should read " 138 ".
- P. 3591, L. 13, insert " The Court : " before " The "
- P. 3595, L. 18 " maintaintd " should read " maintained "
- P. 3595, L. 27, " to " should read " in " after " happen "
- P. 3597, L. 14, " objetcion " should read " objection "
- P. 3598, L. 28, " other " should read " others "
- P. 3599, L. 19, insert " not " after " do "
- P. 3601, L. 9, " transmited " should read " translated "
- P. 3602, L. 17, " detaails " should read " details "
- P. 3603, L. 14, insert " a sample of the concentrate was obtained—
that having been done," after " done,"
- P. 3607, L. 9, " Cattermole " should read " cataract "
- P. 3608, L. 17, insert " with the semi-circular doors, the agitation
resulting " after " apparatus "
- P. 3614, L. 4, cancel (") before " It "

- P. 3614, L. 5, cancel (") after " suit."
- P. 3614, L. 19, cancel period (.) after " grouped "
- P. 3615, L. 31, cancel period (.) after " cite "
- P. 3616, L. 8, insert " in the form of a froth or especially as a gaseous froth," after " surface,"
- P. 3617, LL. 24 & 25 & 26, cancel from " and " to and including " acid "
- P. 3619, L. 9, change the first " oil " to " oils "
- P. 3620, L. 24, cancel period (.) after " volatile "
- P. 3622, L. 26, ".09 " should read ".9 "
- P. 3626, L. 11, " concentrate " should read " concentrates "
- P. 3626, L. 26, " olefine " should read "olefine "
- P. 3627, L. 13, insert " the clear intent of certain features of " before " the invention "
- P. 3633, L. 20, insert " form " after " vortex "
- P. 3633, L. 29, " a " should read " at "
- P. 3639, L. 3, " Johnston " should read " Johnson "
- P. 3639, L. 9, " Johnston " should read " Johnson "
- P. 3641, L. 4, insert " cell " after " which "
- P. 3643, L. 2, " amounted " should read " mounted "
- P. 3645, L. 21, " Sullivan " should read " Sulman "
- P. 3647, L. 14, insert (") after " solution "
- P. 3647, L. 20, insert (") after " particles "
- P. 3649, L. 7, " colloqually " should read " colloquially "
- P. 3650, L. 9, " at " should read " had "
- P. 3654, L. 8, insert " Hill " after " Fryer "
- P. 3654, L. 20, " received " should read " receiver "
- P. 3658, L. 25, insert " after " after " because "
- P. 3658, L. 29, " Or " should read " Of "
- P. 3659, L. 8, insert " of " after " satisfied "
- P. 3659, L. 15, cancel (") before " In "; insert " floating " after " In "
- P. 3659, L. 15 & 16, cancel " floating " and (.) after " mass "
- P. 3659, L. 18, insert " fans " after " these "
- P. 3659, L. 29, cancel (") after " illustrations "
- P. 3660, L. 10, " affect " should read " effect "
- P. 3660, L. 12, " affect " should read " effect "
- P. 3660, L. 29, " silght " should read " slight "
- P. 3662, L. 20, " Cryley " should read " Criley "
- P. 3662, L. 26, " sulphate " should read " sulphurets"; " rise " should read " rose "; " is " should read " was "
- P. 3664, L. 14, " of " should read " or "
- P. 3664, L. 22, " of " should read " or "
- P. 3665, L. 17, " silicious " should read " silicious "
- P. 3665, L. 24, insert " to " after " referred "
- P. 3668, L. 18, insert " in a small test experiment " after (,)
- P. 3668, L. 19, cancel (") before " The "
- P. 3668, L. 25, " rapidly " should read " readily "
- P. 3670, L. 2, " analoguous " should read " analogous "
- P. 3672, L. 30, " any " should read " my "
- P. 3672, L. 31, " to any " should read " with "

- P. 3673, L. 22, insert (,) after " advised "
- P. 3674, L. 28, " separte " should read " separate "
- P. 3675, L. 12, insert " Stirring " after " The "
- P. 3675, L. 14, " bring " should read " break "
- P. 3675, L. 26, " concentration " should read " concentrates ";
" falls " should read " fall "
- P. 3677, L. 8, " flowing " should read " blowing "
- P. 3677, L. 9, " here " should read " there "
- P. 3677, L. 30, insert " as " after " used "
- P. 3679, L. 13, " practice " should read " practiced "
- P. 3679, L. 30, " by " should read " when "
- P. 3680, L. 3, (,) should read (-) after " water "; " an " should
read " in "; (:) should read (-) after " emul-
sion "
- P. 3680, L. 19, " decided " should read " decisive "
- P. 3680, L. 26, " , " should read "(" before " varied "; " varied " should
read " differing ";
- P. 3680, L. 28, " , " should read "() " after " oil "
- P. 3681, L. 3, " and " should read " or "
- P. 3681, L. 5, " larger " should read " ready "; " of " should read
" for "
- P. 3683, L. 20, " contained " should read " downward "
- P. 3684, L. 6, " and " should read " while "
- P. 3684, L. 7, after " gangue " insert " remaining $\frac{1}{2}$ in admixture
with "; erase " in "
- P. 3684, L. 11, " this " should read " the "
- P. 3684, L. 13, " very " should read " not "
- P. 3684, L. 14, cancel " the "
- P. 3685, L. 9, " aeratiou " should read " aerating "
- P. 3687, L. 19, cancel " and was— "
- P. 3687, L. 22, insert (,) after " Sulman "
- P. 3689, L. 6, " is " should read " in " after " produced "
- P. 3697, L. 18, " patent, " should read " patents "
- P. 3702, L. 30, " persence " should read " presence "
- P. 3703, L. 14, insert " grade of " after " the "; " were " should
read " was "
- P. 3706, L. 6, insert " the " after " not "
- P. 3708 LL. 12 & 13, cancel from " in " to and including
" method "
- P. 3709, LL. 15 & 16, cancel from " in " to and including
" method "
- P. 3709, L. 28, " is " should read " it "
- P. 3712, L. 3, " greater " should read " greatly "; " increase " should
read " increased "
- P. 3715, L. 8, cancel " not "
- P. 3715, L. 15, " indicate " should read " indicates "
- P. 3715, L. 21, " appearanc " should read " appearance "
- P. 3718, L. 14, " You think " should read " And the "
- P. 3719, L. 15, " tanks " should read " tank "; insert " B, "
- P. 3723, L. 26, " separation " should read " specification "

- P. 3730, L. 15, insert " don't wish to make t continuous operation, then you can " after " you "
- P. 3733, LL. 26 & 27, cancel from " of " to and including " flota-tion "
- P. 3734, L. 8, " used " should read " said "
- P. 3734, L. 21, insert " in " after " is "
- P. 3735, L. 3, " drip " should read " drop- "
- P. 3735, L. 4, " dripping " should read " dropping "
- P. 3736, L. 4, " dripping " should read " dropping "
- P. 3736, L. 7, insert " of " after " 4 "
- P. 3736, L. 13, " constant service " should read " contact surface "
- P. 3739, L. 29, cancel " and water "
- P. 3740, L. 16, insert comma (,) and (") after " emulsified "
- P. 3740, L. 22, " conditions " should read " condition "
- P. 3740, L. 29, insert " in " after " tion "; " so " should read " sub "
- P. 3741, L. 13, " homoeogenized " should read " homogenized "
- P. 3741, L. 29, " seen " should read " due to "
- P. 3746, L. 26, " Burns " should read " Byrnes "
- P. 3747, L. 22, " Burns " should read " Byrnes "
- P. 3747, L. 23, " Burns " should read " Byrnes "
- P. 3748, L. 24, " Burns " should read " Byrnes "
- P. 3758, L. 17, insert " and " after " would "
- P. 3761, L. 5, " persence " should read " presence "
- P. 3761, L. 21, " bubble " should read " coating "
- P. 3762, L. 16, " emissible " should read " imiscible "
- P. 3763, L. 23, " becomes " should read " become "
- P. 3764, L. 23, should come after L. 24.
- P. 3766, L. 2, " form " should read " from "
- P. 3766, L. 6, " 525 " should read " 535 "
- P. 3769, L. 27, " emulsifying " should read " emulsified "
- P. 3773, L. 28, " creosol " should read " cresol "
- P. 3773, L. 31, " blackish " should read " whitish "
- P. 3774, L. 3, " osol " should read " sol "
- P. 3774, L. 5, " suitably " should read " beautifully "
- P. 3774, L. 14, (") should read (') after " bubble."
- P. 3774, L. 15, " knowu " should read " shown "
- P. 3774, L. 21, cancel (") after " cresol "
- P. 3775, L. 24, " conditions " should read " conclusions "
- P. 3775, L. 26, insert " 50 " before " Q."
- P. 3776, L. 13, " consists " should read " consist "
- P. 3777, L. 5, " operate " should read " operates "
- P. 3777, L. 22, cancel " and "; insert (-); " agitated " should read " agitation "
- P. 3778, L. 6, " the water " should read " wet "
- P. 3778, L. 13, " water " should read " wet "
- P. 3778, L. 15, " her " should read " hers "
- P. 3779, L. 14, " 1866 " should read " 1886 "
- P. 3782, L. 17, " 271 " should read " 571 "
- P. 3783, L. 13, " bitumin " should read " bitumen "
- P. 3783, L. 24, tumin " should read " tunen "

- . 3784, L. 27, " any " should read " my "
- . 3786, L. 9, insert " air " after " oiled "
- . 3786, L. 10, " stabilizzed " should read " stabilized "
- . 3788, L. 8, " agitation " should read " rotation "
- . 3789, L. 19, " Gagna " should read " Magna "
- . 3794, L. 13, Cancel " is "
- . 3800, L. 9, " nise " should read " nisi "
- . 3800, L. 10, insert " m " after " is "; cancel " is " after
" counsel "
- . 3801, L. 5, " offensev " should read " offensive "
- . 3803, L. 21, insert " these " after " have "
- . 3804, L. 2, " negal " should read " legal "
- . 3810, L. 29, " 15 " should read " 14 "
- . 3812, L. 12, " recovered " should read " reversed "
- . 3812, L. 29, " positoin " should read " position "
- . 3813, L. 13, cancel " conditions "; insert " in no way " after
" is "
- . 3821, L. 1, " icat " should read " fact "
- . 3821, L. 11, " More " should read " Mere "
- . 3822, L. 8, insert " if " after " for "
- . 3827, L. 17, " passes " should read " pass "
- . 3831, L. 10, " was " should read " were "
- . 3831, L. 14, " analysis " should read " analyses "
- . 3833, L. 13, " was " should read " were "
- . 3834, L. 8, " cehcked " should read " checked "
- . 3841, L. 28, " Door " should read " Dorr "
- . 3842, L. 4, " Door " should read " Dorr "
- . 3843, L. 7, cancel (") before " Exhibit "
- . 3847, L. 27, " 130 " should read " 139 "
- . 3849, L. 12, cancel " the "
- . 3851, L. 11, " an " should read " any "
- . 3856, L. 8, insert " the essential oil may be in part soluble or
not," after " whether "
- . 3858, L. 7, " mineralized " should read " mineral "
- . 3858, L. 9, " bitumin " should read " bitumen "
- . 3858, L. 13, insert " and bring said globules " after " les "
- . 3858, L. 20, " proceeds " should read " process "
- . 3858, L. 28, insert " I " after " as "
- . 3864, L. 14, cancel (") after " outlined."
- . 3864, L. 16, insert " large quantity of oil was used and the three
experiments when a " after " a "
- . 3865, L. 8, " Molybendite " should read " Molybdenite "
- . 3868, L. 26, " groms " should read " grams "; " aomunt "
should read " amount "
- . 3872, L. 9, " treatments " should read " retreatments "
- . 3872, L. 17, insert " which way they did it? A. I give two
statements " after " certain "
- . 3872, L. 22, " Bute " should read " Butte "
- . 3874, L. 5, insert " The No. 3 cleaner produced a finished con-
centrate " after " concentrate."
- . 3874, L. 18, " they are " should read " of all "

- P. 3875, L. 17, " 53 " should read " 52 "
- P. 3875, L. 23, " sepaarted " should read " separated "
- P. 3876, L. 20, " cels " should read " cells "
- P. 3877, L. 16, insert " it " after " why "
- P. 3881, L. 27, " 51.8 1/2 " should read " 15.8 $\frac{0}{0}$ "
- P. 3883, L. 3, " Janey " should read " Jänney "
- P. 3884, L. 23, " 28th " should read " 29th "
- P. 3886, L. 28, " is it " should read " it is ": insert (,) after " cop-
peras "
- P. 3886, L. 29, insert (,) after " pounds "
- B. 3888, L. 5, " 1906 " should read " 1916 "
- P. 3889, L. 31, " degree " should read " degrees "
- P. 3892, L. 11, cancel " it "
- P. 3893, L. 24, " ton " should read " tons "
- P. 3894, L. 23, " anything " should read " many things "
- P. 3896, L. 14, insert " end " after " head "
- P. 3896, L. 21, " product " should read " products "
- P. 3900, L. 19, insert " then started and 60 pounds of Butte &
Superior ore were " before " added "
- P. 3900, L. 29, " 1.265 " should read " 1.266 "
- P. 3901, L. 28, " foth " should read " froth "
- P. 3903, L. 10, " possible " should read " possibly "
- P. 3904, L. 6, insert " of ore " after " proportion "
- P. 3905, L. 21, " the- " should read " they "
- P. 3905, L. 22, cancel " in which to incline or present the pulp "
and insert " incline as presented to the pulp "
- P. 3907, L. 36, " thr " should read " the "
- P. 3909, L. 12, insert " that " after " that "
- P. 3909, L. 15, cancel " to "
- P. 3910, L. 11, " here " should read " there "
- P. 3919, L. 16, " patentee " should read " patentees "
- P. 3920, L. 19, insert " (" before " where "
- P. 3922, L. 26, cancel " of oil "
- P. 3943, L. 24, insert " X " before " Q. "
- P. 3943, L. 27, " " " " " "
- P. 3943, L. 29, insert " X " before " Q. "
- P. 3944, L. 4, insert " X " before " Q. "
- P. 3944, L. 7, " " " " " "
- P. 3944, L. 10, " " " " " "
- P. 3944, L. 12, " " " " " "
- P. 3944, L. 15, " " " " " "
- P. 3944, L. 17, " " " " " "
- P. 3944, L. 19, " " " " " " ; " know " should read
" knew "
- P. 3945, L. 5, " " " " " "
- P. 3945, L. 8, " " " " " "
- P. 3945, L. 13, " " " " " "
- P. 3945, L. 20, " " " " " "
- P. 3945, L. 23, " " " " " "
- P. 3945, L. 25, " " " " " "
- P. 3945, L. 30, " " " " " "

- P. 3946, L. 3, insert " X " before " Q. "
- P. 3946, L. 6, " " " "
- P. 3946, L. 10, " " " "
- P. 3946, L. 12, " " " "
- P. 3946, L. 17, " " " "
- P. 3946, L. 20, " " " "
- P. 3946, L. 23, " " " "
- P. 3946, L. 26, " " " "
- P. 3946, L. 30, " " " "
- P. 3948, L. 20, insert " an " after " to "
- P. 3950, L. 22, insert " were " after " tests "
- P. 3954, L. 19, " 1 " should read " 2 "
- P. 3956, L. 27, cancel " in "
- P. 3958, L. 16, cancel " 44 "
- P. 3959, L. 31, " this " should read " that "
- P. 3966, L. 2, " counsel " should read " Counsel "
- P. 3966, L. 16, insert " Company " after " Copper "
- P. 3967, L. 19, " prominence " should read " experieence "
- P. 3968, L. 10, " might " should read " my "
- P. 3972, L. 5, insert " amount of sulphuric acid or some " after
" smaller "
- P. 3972, L. 28, period (.) should read (,) after " overflow "; " The "
should read " the "
- P. 3973, L. 28, insert " procedure? A. The matter of procedure
that was outlined an dearried on in this machine.
Q. 107. Well, not in any detail, Mr. Hyde. It
is in the letter; But what I wanted particularly
was the matter of " after " of "
- P. 3980, L. 19, " 2nd " should read " 22nd "
- P. 3982, L. 8, " same " should read " some "
- P. 3984, L. 12, " sustained " should read " overruled "
- P. 3985, L. 2, cancel " they "
- P. 3985, LL. 27 & 28, cancel
- P. 3986, L. 2, erase " () " before " I " and after " did. "; cancel
" I do not remember of having "
- P. 3986, L. 3, erase " had any such knowledge ".
- P. 3990, L. 5, " genelemen " should read " gentlemen "
- P. 3990, L. 29, " rigths " should read " rights "
- P. 3991, L. 4, insert " as " after " here "
- P. 3994, L. 22, " asid " should read " said "
- P. 3996, L. 28, " cotract " should read " contract "
- P. 4002, L. 2, " those " should read " these "
- P. 4002, L. 6, insert " engaged " after " when "
- P. 4002, L. 27, insert " is that correct " after " services? "
- P. 4004, L. 12, insert " with " after " memory "
- P. 4005, L. 8, " of " should read " in "
- P. 4006, L. 15, " cross examinatus " should read " some correc-
tions "
- P. 4013, L. 15, " situtation " should read " condition "
- P. 4014, L. 7, " reilazed " should read " realized "
- P. 4015, L. 18, " Sondejeimer " should read " Sondheimer "

- P. 4016, L. 24, insert " might " after " that "
- P. 4016, L. 28, insert " such " after " of "
- P. 4025, L. 1, insert " considered by this Court, and certainly it would not be "
- P. 4027, L. 19, " with " should read " which "
- P. 4035, L. 11, " An " should read " And "
- P. 4042, L. 1, " Greininger " should read " Greninger "
- P. 4042, L. 6, " licenses " should read " licensees "
- P. 4042, L. 12, " Greininger " should read " Greninger "
- P. 4042, L. 18, " GREININGER " should read " GRENINGER "
- P. 4043, L. 1, " Greininger " should read " Greninger "
- P. 4043, L. 7, cancel (,) after " Separation "
- P. 4043, L. 8, " Ltd., 1913," should read " 1913, Ltd.,"
- P. 4044, L. 4, " Mineral " should read " Minerals "
- P. 4045, L. 9, " Mineral " should read " Minerals "
- P. 4046, L. 8, " Mineral " should read " Minerals "
- P. 4047, L. 27, " creosote " should read " cresol "
- P. 4048, L. 29, " Mineral " should read Minerals "
- P. 4049, L. 6, erase (,) after " Separation "; cancel " Limited "
- P. 4049, L. 7, insert " Limited " after " 1913 "
- P. 4052, L. 18, " larger " should read " large "
- P. 4053, L. 9, cancel " the slimes,"
- P. 4057, L. 8, " wihch " should read " which "
- P. 4060, L. 22, cancel " which was— "
- P. 4060, L. 25, " mixture " should read " time "
- P. 4062, L. 4, insert " was " after " it "
- P. 4062, L. 20, " was " should read " is "; insert " the " after " from "
- P. 4066, L. 9, " mixture " should read " mixtures "
- P. 4066, L. 24, " it " should read " at " after " started "
- P. 4071, L. 18, " at " should read " and "
- P. 4071, L. 24, insert " X " before " Q."
- P. 4074, L. 21, " assay " should read " assays "
- P. 4076, L. 27, " where " should read " were "
- P. 4078, L. 3, erase (,) after " Separations "; " was " should read " were "
- P. 4079, L. 23, " .57 " should read " .67 "
- P. 4079, L. 29, " in " should read " and "
- P. 4079, L. 30, insert (,) after " nine "; cancel (,) after " S."
- P. 4080, L. 5, insert " east side " before " all "
- P. 4080, L. 15, cancel " There "
- P. 4080, L. 16, cancel " were ; " " as " should read " As "
- P. 4080, L. 25, cancel " in "
- P. 4085, L. 7, cancel (;) after " whole "
- P. 4085, L. 11, cancel " that "
- P. 4085, L. 26, " not " should read " no "
- P. 4086, L. 18, " analysis " should read " analyses "
- P. 4086, L. 29, insert " to develop " after " attempting "
- P. 4088, L. 9, " flotation " should read " agitation "
- P. 4088, L. 10, " 312 " should read " 317 "
- P. 4088, L. 18, cancel " And there "

- P. 4088, L. 23, "this air" should read "the pulp"
- P. 4091, L. 10, insert "R" before "X"
- P. " L. 12, " " " "
- P. " L. 15, " " " "
- P. " L. 17, " " " "
- P. " L. 21, " " " "
- P. " L. 23, " " " "
- P. " L. 29, " " " "
- P. 4092, L. 2, " " " "
- P. 4093, L. 11, cancel comma (,) after "Separation"
- P. 4093, L. 22, "condition" should read "conditions"
- P. 4094, L. 7, "demonstration" should read "demonstrations"
- P. 4094, L. 17, "San Diego" should read "Santiago"
- P. 4094, L. 18, "San Diego" " " "
- P. 4095, L. 6, "recommenadtions" should read "recommendations"
- P. 4100, L. 30, "test" should read "tests"
- P. 4101, L. 16, "results" should read "result"
- P. 4103, L. 23, "and" should read "acid" after "kerosene"
- P. 4105, L. 28, "Electric" should read "Electrolytic"
- P. 4106, L. 8, "There" should read "They"
- P. 4108, L. 16, insert "Alumina" after " $A.l_2O_3$ "
- P. 4113, L. 9, insert "and two pounds of acid sludge. That figure for creosote" after "osote"
- P. 4118, L. 28, "grinding" should read "regrinding"
- P. 4123, L. 4, "accomplished" should read "accompanied"
- P. 4124, L. 26, insert "R" before "X"
- P. 4125, L. 9, " " " "
- P. " L. 13, " " " "
- P. " L. 16, " " " "
- P. " L. 22, " " " "
- P. " L. 26, " " " "
- P. 4126, L. 4, " " " "
- P. " L. 8, " " " "
- P. " L. 13, " " " "
- P. 4127, L. 13, insert "or were you" after "you"
- P. 4128, L. 16, "as" should read "to"
- P. 4133, L. 4, "Average" should read "Averages"
- P. 4133, L. 25, insert, "three pounds of the mixture of oil to the ton of ore," after "ore"
- P. 4140, L. 16, "loading" should read "hauling"
- P. 4141, L. 11, "put" should read "but"
- P. 4141, L. 18, "38" should read "88"
- P. 4142, L. 28, "so" should read "80"
- P. 4143, L. 30, insert "over" after "machine"
- P. 4144, L. 16, "minerals separation" should read "Minerals Separation"
- P. 4145, L. 23, insert "Did you know that before Mr. Owen told you. A." after "119."
- P. 4147, L. 15, "oue" should read "ore"
- P. 4149, After L. 2, insert "x-Q. 144. And the tails?"

- P. 4150, After L. 19, insert " x-Q. 155. You know why you did not make a better recovery? "
- P. 4153, L. 17, cancel " the-I added "
- P. 4153, L. 18, " reports ", should read " return "
- P. 4162, L. 13, " Pupine " should read " Pupin "
- P. 4162, L. 16, " general " should read " assistant "; cancel " the "
- P. 4162, L. 26, insert " there " after " method "
- P. 4163, L. 10, " ces " should read " cess "
- P. 4164, L. 18, " liquified " should read " liquefied "
- P. 4165, L. 25, " Beumuelen " should read " Bemmelen "
- P. 4166, L. 3, insert comma (,) after " that "
- P. " L. 4, insert comma (,) after " interface "
- P. 4166, L. 10, " to " should read " may "
- P. " L. 21, " Beumuelen " should read " Bemmelen "; erase " a "
- P. 4167, L. 6, " millimeters " should read " inches. "
- P. 4167, L. 10, insert " was " after " That "
- P. 4167, L. 25, cancel " which-by "
- P. 4167, L. 26, cancel " the range of forces "; insert " and " after " exclusively, "
- P. 4167, L. 27, cancel (-) after " coherent "
- P. 4168, L. 9, " a " should read " as " after " functions "
- P. 4169, L. 5, insert " is " after " This "
- P. 4169, L. 8, insert (") before " this "
- P. 4169, L. 10, " " after " gangue "
- P. 4169, L. 19, insert " a " after " to "
- P. 4169, L. 30, " (.) after " bubbles "; " what " should read " What ": insert " is " after " be "; " independ-" should read " depend- "
- P. 4171, L. 10, " mentioned " should read " mention "
- P. 4171, L. 17, " Park " should read " Parks "
- P. 4172, L. 11, cancel " one hundred "
- P. 4172, L. 18, " simply " should read " simple "
- P. 4173, L. 10, cancel " hundred "
- P. 4173, L. 11, " " "
- P. 4173, L. 21, " DEFENDANT'S " should read " PLAINTIFF'S "
- P. 4174, L. 8, " as " should read " at "
- P. 4174, L. 10, cancel " that "
- P. 4174, L. 17, " layer " should read " film "
- P. 4174, L. 21, " upon " should read " up on "
- P. 4174, L. 29, " present " should read " presence "
- P. 4176, L. 5, cancel " to "
- P. 4176, L. 12, cancel (;) and " and ": " if " should read " If "
- P. 4176, L. 15, cancel " in " after " and "
- P. 4176, L. 20, cancel (.) after (tom)
- P. 4176, L. 20, cancel period (.) after " purposes "; " You " should read " you "
- P. 4176, L. 21, erase (.) after ") "
- P. 4176, L. 25, " the " should read " these "
- P. 4177, L. 5, " 5.32 " should read " 532 " ;
- P. 4177, L. 7, period (.) should read comma (,) after " thinnest "

- P. 4177, L. 8, " is " should read " are "
- P. 4177, L. 18, insert (.) after " particles "
- P. 4178, L. 29, erase (.) ; insert (?) after " much "
- P. 4179, L. 9, insert (?) after " mineral "
- P. 4181, L. 27, " care " should read " cares "
- P. 4182, L. 12, " surfac " should read " surface "
- P. 4184, L. 25, insert ") " after " limit "
- P. 4184, L. 26, insert " (" before " the hands "
- P. 4187, L. 20, " also " should read " Ah ! "
- P. 4187, L. 23, " the " should read " The "
- P. 4190, L. 3, " could " should read " should "
- P. 4190, L. 22, insert " as " after " remove "
- P. 4190, L. 27, insert " and an evenly oiled particle ; We have now made the bubble " before " in "
- P. 4192, L. 9, " drawn " should read " draws "
- P. 4193, L. 8, insert " 21 " before " Now "
- P. 4193, L. 24, " remarked " should read " washed "
- P. 4195, L. 23, insert " , you notice the water on the upper surface " after " surface "
- P. 4196, L. 31, " mineral as " should read " minus "
- P. 4199, L. 3, " of " should read " or "
- P. 4199, L. 6, " Kith " should read " With "
- P. 4200, L. 4, " in " should read " with "
- P. 4200, L. 6, insert " oil-water " after " the "
- P. 4201, L. 3, " this " should read " the "
- P. 4202, L. —, " 4002 " should read " 4202 "
- P. 4202, L. 15, " material " should read " materials "
- P. 4204, L. 11, " this " should read " these " ; " way " should read " ways "
- P. 4204, L. 28, insert " a " after " about "
- P. 4205, L. 23, (;) should read (.) ; " the " should read " The "
- P. 4207, L. 7, " condition " should read " conditions " ; " least " should read " last " ;
- P. 4207, L. 18, insert " (" before " making "
- P. 4207, L. 20, insert ") " after " holder "
- P. 4207, L. 22, cancel " The Witness : With No. 8 with " ; insert " Eighth, with " before " amounts "
- P. 4207, L. 29, " attached " should read " attaches "
- P. 4208, L. 8, " on " should read " and "
- P. 4208, L. 15, change " be " to " de "
- P. 4209, L. 20, insert (,) after " not "
- P. 4209, L. 25, " clear " should read " clean "
- P. 4209, L. 31, cancel (-) after " of "
- P. 4211, L. 6, " b33 " should read " 133 "
- P. 4211, L. 7, insert " , " after " answer "
- P. 4211, L. 26, insert " or " after " surface " ; " surface " should read " surfaces "

ERRATA.

VOLUME VIII.

- P. 4213, L. 23, insert (“) before “ in ”
- P. 4213, L. 27, “ and ” should read “ a ”; insert “ of ” after “ amounts ”; “ amounts ” should read “ amount ”
- P. 4313, L. 28, insert “ and ” after “ surface ”
- P. 4214, L. 3, insert (,) after “ 3 ”; “ comments ” should read “ comment ”
- P. 4215, L. 2, cancel “ as ” after “ perhaps ”
- P. 4215, L. 3, insert “ early in my examination of this phenomena I was fortunate ” after “ but ”
- P. 4215, L. 4, cancel “ was ”
- P. 4215, L. 9, “ question ” should read “ equation ”
- P. 4215, L. 16, insert “ , ” after “ mercury ”
- P. 4216, L. 5, cancel “ of ”
- P. 4216, L. 6, cancel “ and ” after “ extent ”; “ the ” should read “ The ”; insert period (.) after “ extent ”
- P. 4216, L. 11, “ reducing ” should read “ reduced ”
- P. 4218, L. 9, “ this ” should read “ that ”
- P. 4218, L. 24, “ statement ” should read “ question ”
- P. 4219, L. 9, insert comma (,) after “ it ”
- P. 4219, L. 22, “ particle ” should be “ particles ”
- P. 4241, L. 6, after “ necking ” insert “ off ”
- P. “ L. 24, “ a ” should be “ an ”; same line, “ an ” should be “ or ”; same line, erase comma after “ layer ”
- P. 4242, L. 24, “ an ” should be “ or ”; same line, erase comma after “ layer ”
- P. “ L. 25, double quotation mark after “ thick ” should be a single quotation mark.
- P. 4246, L. 9, insert parenthesis before “ Question ”
- P. 4250, L. 3, insert parenthesis before “ and ”
- P. “ L. 4, “ “ after “ yet ”
- P. 4251, L. 12, “ seem ” should be “ seemed ”
- P. 4253, L. 13, “ of ” should be “ or ”
- P. 4254, L. 16, “ in ” should be “ on ”
- P. 4262, L. 15, after “ mean ” insert “ from ”
- P. “ L. 25, insert parenthesis before “ which ”
- P. “ L. 27, “ “ after “ it ” and erase dash
- Page “ 6265 ” should be “ 4265 ”
- P. 4265, L. 8, “ that ” should be “ then ”
- P. 4266, L. 17, before “ sense ” insert “ common ” .
- P. 4269, L. 5, “ oil ” should be “ air ”
- P. “ L. 11, insert a comma after “ whole ”
- P. “ L. 12, after “ surface ” insert “ either ”
- P. “ L. 13, insert a period after “ whole ”; same line, “ where ” should be “ Where ”
- P. “ L. 14, erase “ ore to ” and insert “ air, with ”

- P. 4221, L. 2, insert " Q. 38 $\frac{1}{2}$ " before " Now "
- P. 4221, L. 5, " 20% " should read " 20% "
- P. 4221, L. 13, insert " a " after " be "
- P. 4222, L. 4, erase (,) insert (,) after " froth "; " If " should read " if "
- P. 4222, L. 5, insert " the mineral particles " after " catch "
- P. 4222, L. 7, cancel " the "
- P. 4222, L. 8, cancel " mineral particles " and " that "
- P. 4222, L. 12, " 228 " should read " Q. 28 "
- P. 4223, L. 4, " through " should read " to "
- P. 4223, L. 20, " this " should read " thin "
- P. 4223, L. 25, " be " should read " me "
- P. 4223, L. 26, " Beumuelen's " should read " Bemmelen's "
- P. 4224, L. 3, " the " should read " The "
- P. 4224, L. 13, insert " floated his magnetic spider on the surface of liquid and " after " and "
- P. 4225, L. 6, insert (") before " the "
- P. 4225, L. 13, insert (,) after " prevent "
- P. 4225, L. 18, insert " the " after " to "
- P. 4225, L. 19, insert " , it can be made more stable by adding something or other which will increase the viscosity of the cell wall " after " walls "
- P. 4227, L. 3, " one " should read " on "
- P. 4227, L. 19, cancel " the "
- P. 4227, L. 22, " partice " should read " particle "
- P. 4229, L. 23, " 192 " should read " 199 "
- P. 4230, L. 6, insert " different, because " after " is "; cancel " this " and " in "; insert (.) after " in "
- P. " L. 7, insert " you have " before " a " insert " oil " after " relatively "; cancel " sur " ;
- P. " L. 8, cancel " face " and " but " should read " and "
- P. " L. 11, cancel comma (,) after " time "
- P. " L. 18, insert " Q. 9 " after " 1048 "
- P. " L. 22, " froth " should read " frothing "
- P. " L. 23, insert " (Q. 12-14) " after " 1052, "
- P. " L. 24, insert " (Q. 11-13) " after " 1051 "
- P. 4231, L. 31, cancel " only "
- P. 4232, L. 15, insert " in film, and it is on this peculiar condition of matter " after " matter "
- P. 4232, L. 18, insert " as " after " processes "
- P. 4232, L. 21, insert " (Q. 117) " after " 4 "
- P. 4233, L. 5, insert (x-Qs. 109, 110) " after " 997 "
- P. 4233, L. 6, insert " (x-Q. 110) " after " 997 "
- P. 4233, L. 11, insert " (Q. 20) " after " 18 " ; insert " Qs. 20-23 " after " 962 "
- P. 4233, L. 17, " This " should read " These " ; " again has " should read " give a "
- P. 4233, L. 22, " produces " should read " produce "
- P. 4233, L. 29, insert " Re-x-Q. 256 " after " 10 "
- P. 4234, L. 10, " is " should read " a "

- P. 4234, L. 11, insert " Q. 119 " after " 1110 "
- P. 4234, L. 12, cancel (") before and after " thick "
- P. 4234, L. 13, " limits " should read " limit "
- P. 4234, L. 14, erase " a film that is thick under those conditions "
- P. " L. 14, erase " so "
- P. " L. 19, erase " so "
- P. " L. 22, after the comma insert, " and the oil or "; same line
erase " to " and insert " in "
- P. " L. 23, erase " the " and insert quotation marks after " air "
- P. " L. 24, after " will " insert " not "
- P. " L. 25, insert quotation marks before " and "
- P. " L. 26, insert quotation marks after " bubble "
- P. " L. 27, erase " so " and insert quotation marks before " oil "
- P. " L. 28, " thiek " should be " thin "
- P. " L. 29, " globules " should be " globule "
- P. " L. 30, after " drifting " insert " around "; same line,
" will " should be " may "
- P. 4235, L. 6, after " conclusion " insert " * * * "
- P. " L. 8, erase " air " and insert " oil "; same line, erase
" oil " and insert " air "
- P. " L. 9, erase " uses " and insert " has "; same line, erase
" when "
- P. " L. 11, " when " should be " is "
- P. " L. 12, erase the dash.
- P. " L. 21, after " better " insert " the "
- P. 4236, L. 8, before " and " insert " and nature "; same line, " air
rations " should be " aeration "
- P. " L. 10, " and " should be " to "
- P. " L. 11, insert exclamation point after " necessary "; same
line, " what " should be " That "
- P. " L. 14, after " 1108 " insert " (Q. 118) "; same line, erase
" at the bottom "
- P. " L. 22, after " up " insert " the "
- P. " L. 28, after " says " insert " (Q. 55) "
- P. " L. 29, " amount " should be " degree "
- P. " L. 30, after " is " insert " to be "
- P. 4237, L. 3, after " the " insert " effect of the "
- P. " L. 5, after " oil " insert " * * * "
- P. " L. 27, after " is " insert " Bancroft "
- P. " L. 30, after " that " insert " the "; same line " did "
should be " do "
- P. 4237, L. 31, insert quotation marks after " power "
- P. " L. 32, erase quotation marks.
- P. 4238, L. 19, erase " air "
- P. " L. 21, " There " should be " Where "
- P. 4239, L. 10, " that " should be " the "
- P. " L. 31, " deals " should be " deal "
- P. 4240, L. 22, " hundredth " should be " hundred "
- P. " L. 23, " thousandths " should be " thousand "

- P. 4269, L. 15, insert a comma after "substantial"; "extent which" should be "action to"; "separates" should be "separate"
- P. " 16, "connection" should be "action"
- P. 4269, L. 17, "For" should be "for"; "purpose" should be "purposes"; same line, erase comma after "mind"
- P. " L. 18, after "2137" insert "(Q. 9)"
- P. 4270, L. 4, "maget" should be "magnet"
- P. 4274, L. 5, "oil" should be "air"
- P. 4278, L. 6, "you" should be "your"
- P. 4279, L. 18, "1911" should be "1915"
- P. 4282, L. 4, "irelevant" should be "irrelevant"
- P. " L. 18, "after "Standard" insert "Minerals"
- P. 4286, L. 9, after "a" insert, "0.10 copper tailing from the sand tailing and"
- P. 4295, L. 21, "chines" should be "chiue"
- P. " L. 24, "chines" should be "chine"
- P. 4297, L. 2, after "first" insert "seven"
- P. " L. 20, "clean" should be "lean"
- P. 4298, L. 7, insert "you" after "can"
- P. 4300, L. 19, "tenths" should be "tenth"
- P. 4303, L. 14, erase "The same thing."
- P. " L. 22, "mill" should be "total"
- P. " L. 25, "3" should be "5"
- P. " L. 27, "CaO.2" should be "CaO, O.2"
- P. 4306, L. 28, "has" should be "had"
- P. 4307, L. 11, "per centage" should be "percentage"
- P. " L. 23, "terms" should be "term"
- P. 4308, L. 23, "835" should be "833"
- P. 4309, L. 20, after "next" insert "20"
- P. 4315, L. 27, "United" should be "Union"
- P. " L. 29, erase "The latter,."; same line, "when" should be "When"; after "this" insert "latter"
- P. " L. 30, after "sludge" insert "from the Standard Oil Company, we got a sludge"
- P. 4318, L. 8, after "human" insert "element"; same line, "treating" should be "feeding"
- P. " L. 9, after "ore" insert "to the mill."
- P. " L. 24, erase "submitted" and insert "substituted"; same line, erase comma after "process"
- P. 4319, L. 26, after "treating" insert "slime."
- P. 4320, L. 23, "stantial" should be "stantially"
- P. 4330, L. 25, "concentrate" should be "concentration"
- P. 4330, L. 29, "clear" should be "clay"
- P. 4334, L. 2, erase the comma after "sheet"; same line, "commence" should be "commences"
- P. 4334, L. 27, "261%" should be "26.1%"
- P. 4335, L. 17, after "arrival" insert "at the plant before lunch. After that it only overflowed"
- P. 4336, L. 2, erase "only"

- P. 4341, L. 16, " is " should be " it "
- P. 4353, L. 24, " which " should be " with "
- P. 4354, L. 9, after " one " insert " and "
- P. 4355, L. 13, after " oil " insert " all "
- P. 4360, Lines 12, 16, 18, 21, 25, 29, insert " R " before " x-Q "
- P. 4361, Lines 3, 6, 14, 19, 25, insert " R " before " x-Q "
- P. 4361, L. 19, after " this " insert " same "
- P. 4362, Lines 2, 10, 12, insert " R " before " x-Q "
- P. 4363, L. 9, " continually " should be " continuously "
- P. 4363, L. 18, after " are " insert " now "
- P. 4366, L. 26, " table " should be " tables "
- P. 4370, L. 25, after " copper " insert " iron- "
- P. 4374, L. 4, " Kremer " should be " Kenyon "
- P. 4375, L. 18, " or " should be " ore "
- P. 4375, L. 30, " was " should be " were "
- P. 4375, L. 31, " This " should be " That "
- P. 4380, L. 2, " upper " should be " copper "
- P. 4380, L. 8, " is " should be " are "
- P. 4382, L. 23, insert a semicolon after " insoluble "
- P. 4383, L. 4, " rejection " should be " reject "
- P. 4383, L. 26, " \$1,800.00 " should be " \$1,800,000 "
- P. 4385, L. , insert after x-Q 111, " A. I don't suppose it is quite."
- P. 4391, L. 4, erase " as " and insert " are known "
- P. 4391, L. 5, erase " shown "
- P. 4391, L. 11, " concentration " should be " connection "
- P. 4391, L. 17, " seems " should be " means "
- P. 4391, L. 21, erase " a "
- P. 4391, L. 28, insert a comma after " possible " and after " for "
- P. 4394, L. 26, after " which " insert " have particles of gangue attached to them or which "
- P. 4396, L. 20, " no " should be " not "
- P. 4398, L. 4, " $\frac{1}{8}$ " should be " $1\frac{1}{2}$ "
- P. 4399, L. 25, insert quotation marks after " grains "
- P. 4400, L. 23, " way " should be " very "
- P. 4404, L. 17, " suldge " should be " sludge "
- P. 4405, L. 7, " btttom " should be " bottom "
- P. 4413, L. 7, " realtively " should be " relatively "
- P. 4414, L. 28, " x-Q. 6 " should be " x-Q. 86 "
- P. 4418, L. 6, " gaitator " should be " agitator "
- P. 4420, L. 3, " taind " should be " tain "
- P. 4422, L. 8, " in " should be " if "
- P. 4423, L. 11, after " break " insert " it "
- P. 4428, L. 6, " How " should be " Now "
- P. 4429, L. 15, " streams " should be " streaks "
- P. 4431, L. 17, " considerably " should be " considerable "
- P. 4432, L. 14, " connected " should be " commenced "
- P. " L. 28, after " oil " insert " that was being used, and at first I discovered dark "
- P. 4433, L. 27, " slimes " should be " slime " and " have " should be " has "

- P. 4436, L. 18, " the " should be " this "
- P. 4439, L. 19, " McIlhaney " should be " McIlhiney "
- P. 4440, L. 20, after " the " insert " two "
- P. " L. 22, insert a dash after " sharps "
- P. " L. 30, " figures " should be " figure "
- P. 4442, L. 21, " lime " should be " slime "
- P. 4443, L. 2, " McIlhaney " should be " McIlhiney "
- P. " L. 17, " was " should be " were "
- P. 4444, L. 8, " determintions " should be " determinations "
- P. " P. 24, " McIlhaney " should be " McIlhiney "
- P. 4445, L. 10, " of " should be " for "
- P. " L. 18, " mineral separation " should be " Mineral Separation "
- P. 4448, L. 29, insert quotation marks after " Plant "
- P. 4451, L. 3, " McIlhaney " should be " McIlhiney "
- P. 4451, L. 11, " " " " "
- P. 4454, L. 21, " " " " "
- P. 4454, L. 24, " " " " "
- P. 4456, L. 9, " trate " should be " trates "
- P. 4456, L. 11, " passes " should be " pass "
- P. 4456, L. 13, " tailing " should be " tailings "
- P. 4460, L. 14, " operations " should be " operation "
- P. 4461, L. 11, erase " put "
- P. 4464, L. 2, " slay " should be " clay "
- P. 4464, L. 6, after " quartz " insert " or "
- P. 4469, L. 20, insert a period after " experiments "; same line, " she " should be " She "
- P. 4469, L. 23, after " operations " insert " what she thinks ought to be used in large scale operations. "
- P. 4470, L. 30, erase " you "
- P. 4471, L. 2, erase from " do " to and including " quartz "
- P. 4471, L. 28, erase " X "
- P. 4475, L. 6, after " take " insert " an "
- P. 4475, L. 11, " thiner " should be " thinner "
- P. 4477, L. 6, " tahn " should be " than "
- P. 4477, L. 19, " reference " should be " references "
- P. 4478, L. 17, erase quotation marks before " metalliferous " and after " mineral "
- P. 4478, L. 30, after " shining " insert " -like, "
- P. 4479, L. 9, " can " should be " was "; same line erase " be "
- P. 4479, L. 30, erase line 30
- P. 4479, L. 31, insert " Q. 91. What have you to say as to the significance or "
- P. 4480, L. 2, erase " on "
- P. 4481, L. 25, " attemptping " should be " attempting "
- P. 4482, L. 21, " operation " should be " operations "
- P. 4484, L. 6, after " machine " insert a hyphen
- P. 4484, L. 19, " clases " should be " classes "
- P. 4487, L. 5, erase " reservoir " and insert " receiver "
- P. " L. 10, erase " not "
- P. 4488, L. 17, " posible " should be " possible "

- P. 4491, L. 3, after " Drawing " insert " produced "
- P. 4492, L. 10, " consist " should be " consists "
- P. 4494, L. 30, after " great " insert " difficulty because in several places we found mechanical "
- P. 4496, L. 17, after " Kirby " insert " process in the Kirby apparatus with the Kirby ore and the Kirby "
- P. 4497, L. 20, " elss," should be " less."
- P. 4499, L. 13, after " It " insert " is "
- P. 4502, L. 10, " these " should be " this "; same line, " specifications " should be " specification "
- P. 4503, L. 31, " 5 " should be " 4 "
- P. 4507, L. 21, insert a comma after " carried " and erase the dash
- P. 4509, L. 13, " discernable " should be " discernible "
- P. 4514, L. 13, Insert " A. Yes."
- P. 4515, L. 30, " table " should be " tank "
- P. 4516, L. 11, " agitation " should be " agitator "; same line, after " is " insert " revolved "
- P. " L. 21, after " course " insert " the "; same line, erase " in "
- P. " L. 23, " or " should be " of "
- P. " L. 30, " part " should be " parts "
- P. 4518, L. 10, erase " had then "
- P. " L. 17, " oilve " should be " olive "
- P. 4520, L. 9, erase " them "
- P. 4522, L. 17, after " experiment " insert " they "
- P. 4523, L. 30, after " treatments " insert " they have less oil, and when they have one treatment "
- P. 4524, L. 7, erase " he "
- P. " L. 10, " percolation " should be " percolating "; same line, after " of " insert " a "
- P. 4527, L. 14, erase the comma after " that " and insert a comma after " is "
- P. 4530, L. 17, insert a comma after " casts "
- P. 4533, L. 4, " fiix " should be " fix "
- P. 4538, L. 20, " fg " should be " mg "
- P. 4539, L. 28, " of " should be " if "
- P. 4540, L. 10, before " frothing " insert " mineral "
- P. 4543, L. 26, insert quotation marks after " insufficient "
- P. 4544, L. 18, " circumstance " should be " circumference "
- P. " L. 28, " visable " should be " visibly "
- P. 4545, L. 15, after " being " insert " an "
- P. " L. 21, " bubbles " should be " bubble "
- P. 4547, L. 2, enclose the name " Engler " in parentheses
- P. " L. 3, " 40 " should be " 46 "
- P. 4549, L. 12, after " bubble " insert " to produce "
- P. 4551, L. 2, " suitable " should be " suitably "
- P. 4555, L. 22, Place a period after " absence "; same line, " the " should be " The "
- P. 4558, L. 16, after " photographing " insert a parenthesis
- P. 4560, L. 18, " state " should be " stated "

- P. 4560 L. 29, "examinations" should be "examination"
- P. 4562, L. 3, insert a dash before and after "air"
- P. " L. 4, "soil" should be "oil"
- P. 4563, L. 2, "nonomoleculer" should be "monomolecular"
- P. " L. 13, "above" should be "about"
- P. " L. 26, "attractions" should be "attraction"
- P. 4564, L. 21, insert a comma after "inner"
- P. " L. 22, insert a parenthesis before "as"
- P. " L. 23, after "between" insert "the"; same line, erase
"the"; same line, insert a parenthesis after
"film"
- P. " L. 31, "absorption" should be "adsorption"
- P. 4565, L. 4, erase "of"
- P. " L. 6, "the" should be "thin"
- P. 4566, L. 4, before "from" insert "and"
- P. " L. 5, "19" should be "10"
- P. " L. 29, "upon" should be "before"
- P. 4567, L. 2, insert a period after "conclusive"; same line, "to"
should be "To"
- P. " L. 3, insert a comma after "question"; same line, "We"
should be "we"
- P. 4570, L. 10, after "the" insert "same cell and liquid. The
particles were put back in the"
- P. 4572, L. 4, "Produce" should be "Produces"
- P. " L. 13, after "air" insert "bubble"
- P. " L. 16, "adherance" should be "adherence"
- P. 4574, L. 3, erase "probably" and the dash
- P. " L. 9, after "tend" insert "to rise and the small bubbles
tend"
- P. 4575, L. 2, "1/25,000" should be "1/35,000"
- P. " L. 9, insert a comma after "have"
- P. " L. 28, "on" should be "one"
- P. 4579, L. 2, after "pine" insert "oil"
- P. " L. 10, "taken" should be "taking"
- P. " L. 13, ".049%" should be "0.4%"
- P. 4580, L. 21, after "bubbles" insert a comma
- P. 4581, L. 24, "as" should be "is"
- P. 4582, L. 7, erase "PURE"
- P. " L. 15, "should" should be "shall"
- P. 4583, L. 17, "and" should be "such"
- P. " L. 19, "their" should be "these"; same line, "picture"
should be "pictures"
- P. " L. 24, erase "enormous"
- P. 4584, L. 11, erase the comma after "series" and insert paren-
thesis before "except" and after "oil"; same
line, change "fine" to "pine"
- P. 4588, L. 27, "bottom" should be "back"
- P. " L. 28, insert parenthesis before "the"
- P. " L. 29, " " after "masses"
- P. 4590, L. 9, erase the comma after "bubbles" and insert a par-
enthesi s before "for" and after "center"

- P. 4590 L. 14, " surface " should be " surfaces "
- P. " L. 28, after " froths " insert " of the patent in suit "
- P. 4592, L. 26, " entanglements " should be " entanglement "
- P. 4593, L. 10, " came " should be " streams "
- P. 4595, L. 12, " forthing " should be " frothing "
- P. 4599, L. 11, after " phenol " insert " as "
- P. 4601, L. 29, " rasing " should read " raising "
- P. 4609, L. 7, insert " it " after " that "
- P. 4609, L. 7, " experiment " should read " experiments "
- P. 4610, L. 11, " time " should read " times "
- P. 4610, L. 24, " Dozenbeeh " should read " Dosenbach "
- P. 4612, L. 2, " you on what " should read " Jones so that "
- P. 4613, L. 23, insert " Mr. Williams " after " 458 "
- P. 4617, L. 30, insert " that of " after " day "
- P. 4619, L. 20, insert " c " after " 16c "
- P. 4619, L. 23, insert period (.) before " 15 "
- P. 4623, L. 26, insert " : for the third I was superintendent " after " superintendent "
- P. 4626, L. 27, " divinding " should read " dividing "
- P. 4627, L. 10, " concentarte " should read " concentrate "
- P. 4627, L. 21, " heading " should read " headings "
- P. 4628, L. 19, cancel " column "
- P. 4628, L. 22, insert " — " after " recovery "
- P. 4629, L. 2, insert " — " after " feed "
- P. 4631, L. 14, erase " their "; insert " the Chino "
- P. 4633, L. 8, " they " should read " their "; " used " should read " use "; insert " of " after " used "
- P. 4635, L. 8, " 1916 " should read " 1917 "
- P. 4635, L. 11, " One " should read " And "
- P. 4635, L. 14, " figure " should read " figuring "
- P. 4635, L. 25, insert " were " after " conditions "
- P. 4636, L. 2, insert ") " after " mann, "
- P. 4637, L. 10, " rate " should read " ratio "
- P. 4637, L. 13, insert " weight " after " the "; cancel " contents "
- P. 4638, L. 9, insert " in " after " contents "
- P. 4638, L. 10, " ing " should read " ings "
- P. 4638, L. 16, " net " should read " next "
- P. 4640, L. 4, " east " should read " cost "
- P. 4640, L. 9, " to " should read " of "
- P. 4641, L. 9, " successfully " should read " successful "
- P. 4642, L. 7, " statement " should read " statements "
- P. 4643, L. 6, insert " as " after " used, "
- P. 4645, L. 27, " 53 " should read " 53. "
- P. 4646, L. 11, cancel " tons "
- P. 4646, L. 12, cancel " of "
- P. 4646, L. 30, " tailing " should read " tailings "
- P. 4647, L. 11, " statement " should read " statements "; " gives " should read " give "
- P. 4647, L. 20, " 163 " should read " 166 "
- P. 4649, L. 4, " exhibits " should read " exhibit "
- P. 4650, L. 12, " figure " should read " figured "

- P. 4651, L. 31, " 12,988 " should read " 12.988 "
- P. 4653, L. 13, " heading " should read " headings "; " of " should read " % "
- P. 4653, L. 17, " 294 " should read " 204 "
- P. 4653, L. 24, " 295 " should read " 205 "
- P. 4661, L. 27, " 6,8804 " should read " 6,804 "
- P. 4663, L. 9, insert " tonnage " after " concentrate "
- P. 4670, L. 29, " amount " should read " extent "
- P. 4674, L. 7, cancel " out "
- P. 4674, L. 10, " .0531 " should read " .531 "
- P. 4677, L. 27, " facts " should read " foot "
- P. 4678, L. 16, insert " also " after " are "
- P. 4678, L. 28, " facts " should read " foots "
- P. 4683, L. 8, " 130 " should read " 130° "
- P. 4685, L. 7, " .145 " should read " .155 "
- P. 4685, L. 11, " samples " should read " sample "
- P. 4687, L. 10, " accurate " should read " accurately "
- P. 4688; L. 10, " tailing " should read " tailings "
- P. 4690, L. 25, " infringement " should read " infringed "
- P. 4691, L. 17, " 4 " should read " 5 "
- P. 4696, L. 3, " KRAMER " should read " KREMER "
- P. 4698, L. 22, cancel " to " after " limit "
- P. 4700, L. 27, " 40 " should read " 49 "
- P. 4701, L. 27, " 54 " should read " 55 "
- P. 4704, L. 15, " molting " should read " melting "
- P. 4706, L. 15, insert " portrayed by these moving pictures were experiments " after " ments "
- P. 4708, L. 29, " reflection " should read " reflected "
- P. 4709, L. 15, " has " should read " have "
- P. 4709, L. 27, " illumianting " should read " illuminating "
- P. 4711, L. 6, " entrapped " should read " entrapping "
- P. 4714, L. 2, " 16½ " should read " 16A "
- P. 4714, L. 21, " subject " should read " subjected "
- P. 4714, L. 25, insert " with the froth " after " that "; cancel " the oil "
- P. 4715, L. 4, " effects " should read " effect "
- P. 4717, L. 7, cancel " X "; insert " By Mr. Williams " after " 24 "
- P. 4717, L. 9, insert comma (,) after " Company "; after " is ", and after " Falls "
- P. 4717, L. 15, " each " should read " such "
- P. 4719, L. 3, cancel comma (,) after " Separation "
- P. 4719, L. 10, " " " " " " " "
- P. 4719, L. 13, " ment " should read " mental "
- P. 4720, L. 22, " question " should read " questions "
- P. 4721, L. 12, " pseaking " should read " speaking "
- P. 4721, L. 20, " Wicks " should read " Wicks' "
- P. 4721, L. 29, " flotations " should read " flotation "
- P. 4726, after L. 3, insert " Re-d. Q. 15. Mr. Wilding, you used the same method "
- P. 4727, L. 27, " palintiffs " should read " plaintiffs "

- P. 4729, L. 6, " Greininger " should read " Greninger "
- P. 4729, L. 11, " Greininger " should read " Greninger "
- P. 4730, L. 4, cancel comma (,) after " photographs "
- P. 4731, L. 9, cancel " all the-about the same "
- P. 4733, L. 22, " value " should read " values "
- P. 4737, L. 13, " processes " should read " process "
- P. 4943, L. 28, " readdily should read " readily "
- P. 4744, L. 27, " minute " should read " minutes "
- P. 4746, L. 8, insert " very " after " been "
- P. 4748, L. 28, cancel " holes "
- P. 4752, L. 16, " ore " should read " air "
- P. 4752, L. 23, " manga " should read " magma "
- P. 4754, L. 3, " buiyancy " should read " buoyancy "
- P. 4754, L. 15, " acceptable " should read " acceptible "
- P. 4756, L. 17, " get " should read " give "
- P. 4760, L. 4, " meal " should read " metal "
- P. 4760, L. 12, " simple " should read " simply "
- P. 4761, L. 29, " pionted " should read " pointed "
- P. 4763, L. 3, " aggro " should read " aggre- "
- P. 4763, L. 22, " quality " should read " quantity "
- P. 4765, L. 10, " 189 " should read " 169 "
- P. 4766, L. 12, insert " as " after " agitators "
- P. 4768, L. 11, " resutls " should read " results "
- P. 4770, L. 3, " cleaned " should read " cleared "
- P. 4770, L. 27, " Mechanical " should read " mechanical "
- P. 4771, L. 17, " mean " should read " may "
- P. 4771, L. 31, " was " should read " with "
- P. 4773, L. 4, insert " by " after " test "
- P. 4774, L. 2, " recognizes " should read " recommends "
- P. 4775, L. 12, " battea " should read " batea "
- P. 4777, L. 6, insert " and " after " Sulman "
- P. 4779, L. 16, cancel " x-Q. 236 "
- P. 4780, L. 5, cancel " to "
- P. 4780, L. 11, " phosphites " should read " phosphide "
- P. 4781, Ll. 14 and 15, should come *after* L. 16 (R-x-Q. 244)
- P. 4781, L. 20, " minearl " should read " mineral "
- P. 4783, L. 13, " 25 " should read " 24 "
- P. 4788, L. 2, " drug " should read " drum "
- P. 4788, L. 6, insert " sample " after " same "
- P. 4788, L. 16, " weight " should read " weigh "
- P. 4789, L. 10, " jars " should read " jar "
- P. 4789, L. 16, " analysis " should read " analyses "
- P. 4791, L. 27, " choose " should read " chose "
- P. 4794, L. 12, " it " should read " is " after " it "
- P. 4798, L. 8, insert " a " after " not "
- P. 4800, L. 27, " and " should read " an "
- P. 4804, L. 11, insert " your " after " from "
- P. 4807, L. 9, " therein " should read " there in "
- P. 4816, L. 2, cancel " when "
- P. 4816, L. 10, " inthe " should read " in the "
- P. 4822, L. 25, " asmples " should read " samples "

- P. 4825, L. 21, " Navada " should read " Nevada "
- P. 4826, L. 15, " apera- " should read " aper- "
- P. 4830, L. 6, " use " should read " used "
- P. 4832, L. 20, " No " should read " Now "
- P. 4833, Ll. 12 & 13, cancel both lines.
- P. 4834, L. 1, " Dugeon " should read " Dudgeon "
- P. 4834, L. 2, " Dugeon " should read " Dudgeon "
- P. 4835, L. 1, " Dugeon " should read " Dudgeon "
- P. 4836, L. 1, " Dugeon " should read " Dudgeon "
- P. 4836, L. 2, insert " (" before " Question "
- P. 4843, L. 21, " ne " should read " not "
- P. 4845, L. 11, cancel line.
- P. 4850, L. 22, cancel (-) after " make "
- P. 4854, L. 7, insert " now " after " witness "
- P. 4859, L. 16, cancel " l') " ; insert (") " before " And "
- P. 4859, L. 19, insert (") " and (") " after " bottle ? "
- P. 4860, L. 2, " Bellsley " should read " Wellsley "
- P. 4869, L. 20, " date " should read " data "
- P. 4877, L. 21, insert (") " before " Cost "
- P. 4882, L. 15, " heading " should read " headings "
- P. 4883, L. 4, insert " in " after " higher "
- P. 4887, L. 15, " judicatea " should read " judicata "

ERRATA.

VOLUME IX.

- P. 4894, L. 5, " this " should read " said "
- P. 4895, L. 16, insert (6.) before " From "
- P. 4899, L. 29, " thereto " should read " hereto "
- P. 4901, L. 18, " that the " after " agreed "
- P. 4902, L. 14, " the " should read " this "
- P. 4918, L. 4, erase " not "
- P. 4922, L. 11, " whipping " should read " whipping "
- P. 4922, L. 28, insert " parts of the " after " of the "
- P. 4925, L. 18, " or " should read " of "
- P. 4931, L. 6, " their " should read " this "
- P. 4943, L. 4, insert " suggestion or a single " after " single "
- P. 4943, L. 17, " designated " should read " desigued "
- P. 4945, L. 5, insert " up to that time it had to produce a rough concentrate " after " but "
- P. 4946, L. 25, " Wickes " should read " Wicks "
- P. 4956, L. 18, " license " should read " licenses "
- P. 4958, L. 3, " " " " "
- P. 4961, L. 2, " " " " "
- P. 4962, L. 8, " " " " "
- P. 4965, L. 30, " advantage " should read " advance "
- P. 4966, L. 9, " larger " should read " large "
- P. 4966, L. 12, " agitation " should read " flotation "
- P. 4966, L. 24, " struction " should read " structions "
- P. 4966, L. 27, " improvements " should read " improvement "
- P. 4970, L. 29, insert " the " after " ing "
- P. 4971, L. 4, " Hills " should read " Hill "
- P. 4971, L. 8, " Corbe " should read " Cobre "
- P. 4971, L. 10, " INFRINGEMENT " should read " INFRINGEMENTS "
- P. 4972, L. 17, insert " to the mining Community " after " announced "
- P. 4972, L. 19, " to " should read " of "
- P. 4972, L. 22, " convinving " should read " convincing "
- P. 4977, L. 15, " process " should read " processes "
- P. 4978, L. 19, cancel (") after " liquid "
- P. 4978, L. 20, insert (") before " And "; (") should be (') before " in "; after " water " single quotation
- P. 4979, L. 30, " affecte d " should read " effected "
- P. 4980, L. 10, " the " should read " that "
- P. " L. 12, cancel " what "
- P. " L. 13, " one " should read " a "
- P. " L. 15, " To " should read " The "
- P. " L. 21, " curshed " should read " crushed "; insert " * * * " and cancel (,) after " oil "
- P. " L. 22, insert (') before " the " and after " pulp "
- P. 4981, L. 3, " wilthin " should read " within "

- 4981, L. 12, " was " should read " were "
- 4988, insert on drawing marked " Defendant's Exhibit No. 27," the following: " Tube I regulates liquid level and should extend up to liquid level."
- 5019, Drawing marked " Defendant's Exhibit No. 37," " Ore Feed " should read " Circ. Feed "
- 5038, L. 12, " collecting " should read " collected "
- 5038, L. 6, " gerater " should read " greater "
- 5040, L. 12, insert " so violently " afer " agitated "
- 5042, L. 16, " usd " should read " used "
- 5044, L. 16, " 2400 " should read " 2000 "
- 5048, L. 25, insert " with oil " after " solution "
- 5052, L. 11, " is " should read " in "
- 5141, Defendant's Exhibit No. 125; Column 6, " asasy " should read " assay "
- 5155, Diagram No. 15 ; " Def." should read " Plffs."
- 5156, " " 16 ; " " " " " "
- 5167, Defendant's Exh. No. 151, Col. 4; change " 521 " to " 52 "
- 5187, Defendant's Exhibit No. 159 ; Column 13 ; insert " ore and " after " Oil in "
- 5194, Defendant's Exhibit No. 162, Column 4 ; " Fee " should read " Feed "
- 5194, Defendant's Exhibit No. 162, Column 14; insert " circulating " after " Ore & "
- 5199, L. 4, " pyarmid " should read " pyramid "
- 5208, L. 20, " 35119 " should read " 3519 "
- 5220, L. 21, " Palable " should read " Payable "
- 5235, Defendant's Exhibit No. 192, Column 4 ; " 4.88 " should read " 4.68 "
- 5244, L. 10, insert " A " after " Chart "
- 5261, L. 14, " bu." should read " cu."
- 5261, L. 26, " Calcura " should read " Calura "
- 5264, Mark " 331 "
- 5265, Mark " 332 "
- 5266, Mark " 335 "
- 5267, Mark " 356 "
- 5268, Mark " 357 "
- 5270, should read " P. 5271 "
- 5271, should read " P. 5270 "
- 5278, Defendant's Exhibit No. 219, " Tonnage & " should read " Tonnage & Oil "
- 5293, L. 47, " .8958 " should read " 89.58 "
- 5298, L. 25, " samples " should read " sample "
- 5300, L. 4, " Sohlet " should read " Soxhlet "
- 5300, erase lines 16 & 17 and substitute :
- " Weight oil 0.0250 gms
Weight thimble plus ore (after extraction).. 12.272 gms

- P. 5300, L. 24, "Stingfield" should read "Stringfield"
- P. 5309, Defendant's Exhibit No. 230, Column 21; "973" should read "978"
- P. 5329, Substitute reprint of table
- P. 5350, Plaintiffs' Exhibit No. 246; Mark Part in drawing "8" distinctly.
- P. 5365, Plaintiffs' Exhibit No. 252. Column 11: "0.124" should read "1.124"
- P. 5368, "Scale 6" should read "Scale 6"
- P. 5368 "porportion" should read "proportion"
- P. 5376, L. 7, insert "oil" after "its"
- P. 5376, L. 17, insert "plant" after "flotation"
- P. 5379, L. 18, "1916" should be "1913"
- P. 5380, After line 16 insert: "4. Of the analysis and assay returns of concentrates recovered in its oil flotation plant.....53.940% Zn.
2.956% Pb.
.627% Cu.
2.069% Fe.
.273% Mn.
9.293% Insol.
23.016 Oz. Ag.
.0338 Oz. Au."
- P. 5385, L. 16, Insert "90.4000% Insol."
- P. 5388, L. 7, After "its" insert "oil"
- P. 5388, L. 18, After "flotation" insert "plant"
- P. 5396, L. 12, After "its" insert "oil"
- P. 5396, L. 23, After "flotation" insert "plant"
- P. 5400, L. 10, After "its" insert "oil"
- P. 5401, L. 5, "approximately" should be "approximate"
- P. 5404, L. 11, After "its" insert "oil"
- P. 5404, L. 21, After "flotation" insert "plant"
- P. 5408, L. 10, After "its" insert "oil"
- P. 5408, L. 20, After "flotation" insert "plant"
- P. 5413, L. 17, ".400%" should be ".0400%"
- P. 5420, L. 21, "oils" should be "oil"
- P. 5433, L. 3, After "its" insert "oil"
- P. 5433, L. 3, After "its" insert "oil"
- P. 5436, Column 5, "6564.25" should be "6564.85"
- P. 5441, L. 33, "1913" should be "1912"
- P. 5442, L. 27, "382" should be "362"
- P. 5459, L. 3, After "Whereas" insert "by Clause 2 of the Articles of Association of the Syndicate"
- P. 5460, L. 21, "gasioous" should be "gaseous"
- P. 5461, L. 21, After "Company" insert "All disbursements already made by the Company"
- P. 5462, L. 7, After "dicate" insert "or as it shall direct the premises mentioned in the Schedule hereto and giving to the Syndicate"

- 5465, L. 3, "Syndicate" should be "Syndicate's"
- 5466, L. 3, "Bavey" should be "Bavay"
- " L. 16, erase "8"
- " L. 19, "972678" should be "962678"
- 5468, L. 11, "Layers" should be "Lavers"
- 5473, L. 27, "bill" should be "bills"; same page, line 29,
erase from "and" to and including "demands"
line 30
- P. 5474, L. 27, after "assigns" insert "but at the cost and ex-
pense of said Minerals Separation North
American Corporation, its successors or as-
signs,"
- P. 5475, L. 6, "cobferming" should be "confirming"
- P. 5477, L. 23, "712783" should be "912783"
- P. 5478, L. 4, "1070784" should be "1071784"
- " L. 23, "11558836" should be "1155836"
- P. 5479, L. 7, "76634" should be "766346"
- " L. 29, "Sheelshear" should be "Shellshear"
- P. 5483, L. 3, "To" should be "of"
- P. 5490, L. 13, "unites" should be "units"
- P. 5492, L. 20, erase "he"
- P. 5493, L. 26, "prelude" should be "preclude"
- P. 5495, L. 3, "produce" should be "produced"
- " L. 15, "Balot" should be "Ballot"
- P. 5496, L. 9, "stray" should be "Stray"
- P. 5497, L. 2, After "use" insert "of"; erase line 21; line 26,
"rolayties" should be "royalties"
- P. 5500, L. 12, " $\frac{1}{2}\%$ " should be " $\frac{2}{3}\%$ "; line 14 erase from "or"
to and including "smelters", line 15
- P. 5501, L. 3, after "any" insert "of the inventions specified in
the said letters patent, by the use of any"
- P. 5501, L. 4, erase "of the"
- " L. 7, "or" should be "of"
- " L. 22, insert "For Minerals Separation, Ltd.,
John Ballot,
Francis L. Gibbs, Directors.
A. O. Williams, Secretary."
- P. 5502, L. 17, "Calusa" should be "Colusa"
- P. 5506, L. 3, "as" should be "a"
- P. 5507, L. 9, after "copper" insert "in the concentrates, a unit
of copper"
- P. 5508, L. 14, "Smeltering" should be "Smelting"
- P. 5512, insert at end of page, "A. O. Williams, Secretary."
- P. 5517, L. 15, "tiune" should be "tinue"
- P. 5521, L. 17, "incoroprated" should be "incorporated"
- " L. 29, after "after" insert "the expiration of each quarter,
viz., within thirty (30) days after"
- P. 5523, L. 8, "Letter" should be "Letters"
- P. 5524, L. 13, after "said" insert "other"

- P. 5526, L. 19, "proceeding" should be "proceedings"
- P. 5527, L. 13, "payments" should be "payment"
- P. 5528, L. 9, "if" should be "it"
- P. 5531, L. 28, "579" should be "479"
- P. " L. 53, erase "Agitating Apparatus" and insert "Apparatus for Ore Concentration"
- P. " L. 46, "sulphide" should be "sulphides"
- P. 5532, L. 17, "ore" should be "the"
- P. " L. 29, "Lavers, Lowry" should be "F. J. Lyster"; same line, insert "Ore Concentration"
- P. " L. 31, insert "1,208,171," Dec. 12, 1916, Lavers. Lowry & Greenway"

5

United States Circuit Court of Appeals,
FOR THE NINTH CIRCUIT.

BUTTE AND SUPERIOR MINING COMPANY,
Defendant-Appellant,

vs,

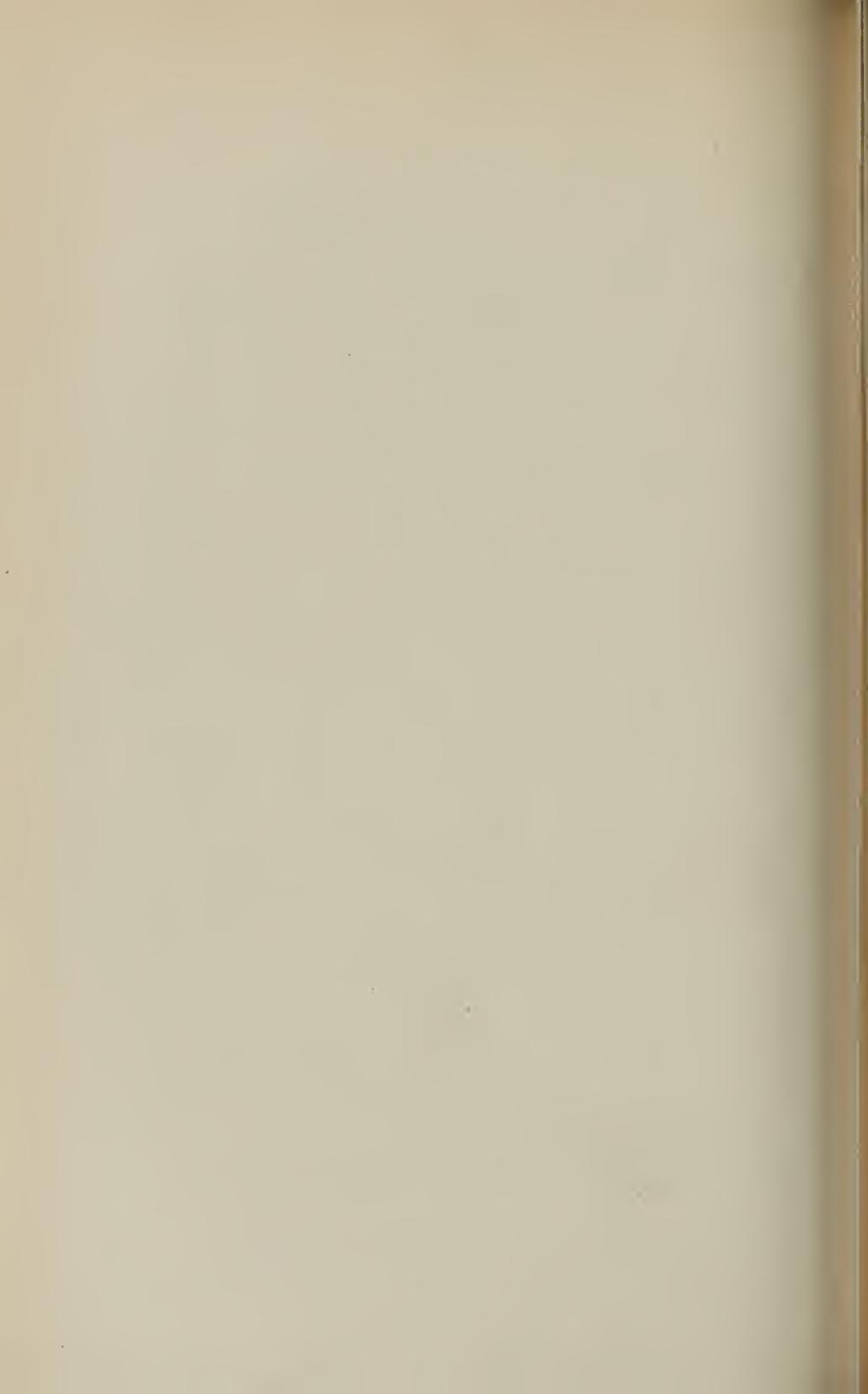
MINERALS SEPARATION, LIMITED, ET AL.,
Plaintiffs-Appellees.

BRIEF FOR DEFENDANT-APPELLANT.

THOMAS F. SHERIDAN,
FREDERICK P. FISH,
J. EDGAR BULL,
J. BRUCE KREMER,
KURNAL R. BABBITT,
Of Counsel.

FILED
FEB 21 1918

F. D. WASHINGTON.



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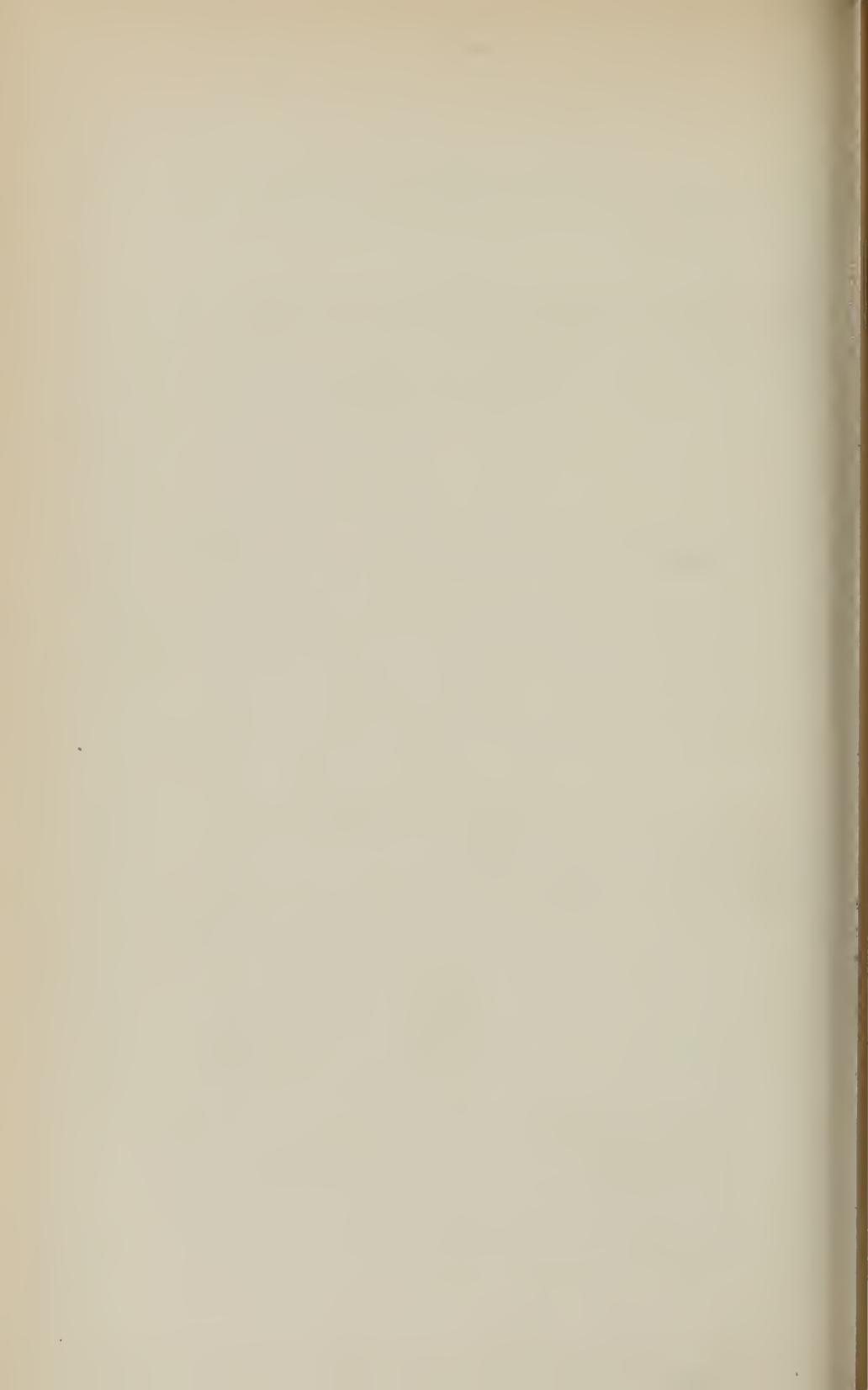
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United States Circuit Court of Appeals

FOR THE NINTH CIRCUIT.

BUTTE AND SUPERIOR MINING
COMPANY,
Defendant-Appellant,

VS.

MINERALS SEPARATION, LIMITED,
ET AL.,
Plaintiffs-Appellees.

BRIEF FOR DEFENDANT-APPELLANT.

This is an appeal from the decision of the District Court sustaining Letters Patent No. 835,120 for Process of Ore Concentration, issued to Sulman, Picard & Ballot, on November 6, 1906, and finding the same to be infringed by the defendant, not only when it has used less than 1% of oil on the ore, but also when it has used more than 1% of oil on the ore.

Prior to January, 1917, the defendant used "oils" (among others oleic acid) in quantities below one-half of 1% on the ore. Since that date it has not used oleic acid at all, but has used other "oils" in quantities always above one-half of 1% on the ore, and for most of the time in quantities above 1% on the ore. (See Defendant.s Exhibit No. 158, Tr., Vol. IX., p. 5184.)

The court below found that prior to January, 1917, defendant infringed all the claims in issue (to wit, claims 1, 2, 3, 5, 6, 7, 9, 10, 11, 12), and that since that date it has in-

fringed all said claims excepting claims 5, 6 and 7, which specifically relate to the use of oleic acid.

The facts presented require this Court to decide not only whether the use of more than 1% of oil infringes the patent in suit, but also whether the use of more than one-half of 1% and less than 1% of oil infringes. Thus, referring to Defendant's Exhibit No. 158 (Tr., Vol. IX., p. 5184), it will be seen that defendant used during the period from January 17 to 29, 1917, 0.84% of oil, and during the period from January 30 to February 3, 1917, 0.80% of oil. So also Defendant's Exhibit No. 161 (Tr., Vol. IX., p. 5192), shows that between February 1 and 9 the amounts of oil used daily were between 0.64% and 0.79%. Subsequently more than 1% of oil on the ore was used by defendant, as shown by said exhibits and Exhibit No. 162 (Tr., Vol. IX., p. 5194). The question whether the use of either of these quantities of oil constituted an infringement of plaintiffs' patent is, therefore, directly presented.

We admit that, under the authoritative and final interpretation of the patent by the Supreme Court, the use of oil in quantities of less than one-half of 1% (as shown by Defendant's Exhibit No. 158, Tr., Vol. IX., p. 5184) infringed; but we contend that, under said interpretation, the use of oil in quantities above one-half of 1% does not infringe.

The patent in suit is the same patent which was before the courts in the Hyde case (*Minerals Separation vs. Hyde*). In that case the learned Judge of the District of Montana (207 Fed., 956) *did not regard the use of a fraction of 1% of oil as of the essence of the patented process*. He therefore sustained not only the claims in issue which were in terms limited to the use of a fraction of 1% of oil (to wit, claims 1, 2, 3, 5, 6, 7, 12), but he also sustained the claims which were in terms broad enough to cover the use of any "small quantity" of oil (to wit, claims 9, 10, 11).

When the Hyde case came before this Court on appeal, an entirely different view of the invention was taken (214 Fed., 100). This Court found that *the essence of the invention consists in the use of a small fraction of 1% of oil*. In its opinion it said (p. 102):

" That which is presented as *new* in the patent, and as the *pivotal discovery on which its validity depends*, is

the formation of a froth or scum containing the metaliferous matter produced by agitation of the pulverized ore in water, by the action of oil in a quantity less than one per cent. of the quantity of ore treated."

Again (p. 104) :

"When the claims and the description of the process of the appellees' patent are compared with the patents of the prior art, it will be seen that the *only material difference is in the smaller quantity of oil which the appellees use.*"

This court also held, as a matter of law, that the reduction in the amount of oil used to a fraction of 1% did not involve patentable subject-matter. It, therefore, remanded the case with directions to dismiss the bill.

Next, the patent in suit came before the learned Judge of the District of Delaware in the Miami case (*Minerals Separation vs. Miami*, 237 Fed., 609). In that case the court found, just as this court had before found, that the *essence of the invention consists in the use of a small fraction of 1% of oil.* In its opinion it said (p. 630) :

"The patentability of the process of the first patent in suit *resides in the use of oil in the extremely minute proportion disclosed in the descriptive portion of the patent* to effect separation of froth with its metallic particles from the remainder of the mixture by flotation. The amount there disclosed is *not in excess of 'a fraction of one per cent. on the ore' and may be only one-tenth of one per cent. on the ore, or even less.*"

The learned District Judge in the Miami case, however, held, as a matter of law, that the use of a small fraction of 1% of oil constituted patentable subject-matter. He therefore sustained those claims in issue there which are in terms limited to a fraction of 1% of oil (to wit, claims 1 and 12), while he held *invalid the claim in issue there which is in terms broad enough to cover the use of any "small quantity" of oil (to wit, claim 9).**

Subsequently, the Hyde case came before the Supreme Court by *certiorari* (242 U. S., 261). The Supreme Court

* Claims 10 and 11 were not put in issue in the Miami case.

agreed with this court, and with the District Judge in the Miami case, in finding that the *use of a fraction of 1% of oil is of the essence of the invention.* It said (p. 265) :

“ The process of the patent in suit, as described and practiced, *consists in the use of an amount of oil which is ‘critical,’ and minute as compared with the amount used in the prior processes, ‘amounting to a fraction of one per cent. on the ore.’* ”

Again (p. 271) :

“ While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, ‘turned failure into success’ (The Barbed-Wire patent, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one, and the *patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as ‘critical proportions’ ‘amounting to a fraction of one per cent. on the ore.’* ”

While the Supreme Court held, as a matter of law, that the use of a small fraction of 1% of oil constituted patentable subject-matter, it specifically condemned the view taken by the District Judge in the Hyde case that the use of a small fraction of 1% is not of the essence of the invention. It said (p. 271) :

“ While we thus find in favor of the validity of the patent, *we cannot agree with the District Court in regarding it valid as to all of the claims in suit.* ”

It, therefore, declared invalid those claims which in terms are broad enough to cover the use of any “small quantity” of oil (to wit : claims 9, 10 and 11) and sustained only those claims which are in terms limited to the use of a “fraction of one per cent. of oil.”

Subsequently, the Miami case came before the Circuit Court of Appeals for the Third Circuit (244 Fed., 752). Since the questions of validity and scope of the patent in suit at that time had been authoritatively determined by the Supreme Court, the only questions considered were (1) the scope of the patent as

etermined by the Supreme Court, and (2) infringement. As to infringement, the decision of the court was not unanimous; but as to the fact that the Supreme Court had strictly limited the patent to the use of a fraction of 1% of oil, it was entirely unanimous. Discussing the contention of plaintiff in that case, that (p. 758): "Whenever the modifying agent of the patent (oil) is used, a person infringes who gets air in the pulp in any fashion and agitates the mixture by any means to sufficient extent to cause the mineral particles to attach themselves to air bubbles, and to rise therewith above the top of the mixture in a collection of bubbles and metal particles, or wit, froth," the court said (p. 758):

"The contention of the plaintiff, at least, omits the *very definite limitation* of the patent to the results obtained by the use of oil *within the described proportions.*"

Again it said, referring to the Supreme Court's decision (p. 759):

"The District Court had held valid certain claims in which the proportion of oil was described simply as 'a small quantity', and the Supreme Court, in reversing that finding and holding those claims invalid, used the quoted words of limitation in confining the patent to the results obtained by the use of oil in the *critical proportions of less than 1%.*"

Further on in its opinion it said (p. 760):

"The affinity of oil for metal was known, and, though old, was employed in the invention; but that this affinity in a given condition is greatest when its quantity is relatively least, or that the affinity increases with the decrease of oil below a given quantity (*less than 1%*), is the *soul of the discovery and was wholly new.*"

We, therefore, see that, in succession, this court in the Hyde case, the District Court of Delaware in the Miami case, the Supreme Court in the Hyde case and the Court of Appeals of the Third Circuit in the Miami case, all agreed in

holding—and in so holding they all disagreed with the District Court of Montana—that the *use of a fraction of 1% of oil is of the essence of the patented process ; and that the use of larger quantities of oil are not, and cannot be covered by the claims of the patent in suit.*

As we read the decision below in this case (Tr., Vol. I., p. clxxvii), it seems to us that the learned District Judge has overlooked these facts. It seems to us that he has overlooked the fact that the Supreme Court did not agree with him in finding that the patentees are entitled to cover the use of any “small quantity” of oil ; but, on the contrary, that the Supreme Court agreed with this Court in finding that *the use of a small fraction of 1% of oil is of the essence of the patented process.* The opinion of the District Court in this case, holding that the use by defendant of 1% and more of oil infringes, seem to us to be a reaffirmance in all respects of its decision in the Hyde case, *including the errors in it which have been condemned by the Supreme Court.*

THE QUESTIONS TO BE DECIDED.

Since the Supreme Court has in the Hyde case authoritatively determined the rights of the plaintiffs under the patent in suit, this court at this time has only three questions to decide :

The first question is : What has the Supreme Court decided in the Hyde case as to the metes and bounds of the invention at bar, and does the use of oil in proportions greater than the so-called “critical proportions” trespass upon any just rights of the plaintiffs, as those rights have been defined by the Supreme Court ?

The second question is : Is the new evidence presented in this case—evidence not before the Supreme Court in the Hyde case—of such character as, in the opinion of this court, would have led the Supreme Court to reach a different conclusion if it had been presented in the Hyde case ?

The third question is : What is the purpose and effect of the so-called “disclaimer” filed by the plaintiffs after the opinion of the Supreme Court in the Hyde case was handed down ?

I.

The Metes and Bounds of the Patent in Suit as Defined by the Supreme Court in the Hyde Case.

The first question—to-wit: What has the Supreme Court decided in the Hyde case as to the metes and bounds of the invention at bar, and does the use of oil in proportions greater than the so-called “critical proportions” trespass upon any just rights of the complainant, as those rights have been defined by the Supreme Court?—requires this court only to study and apply the decision of the Supreme Court. Whether we or our adversaries think it right or wrong, that decision is the law of the land with respect to the patent in suit, on the facts presented in the Hyde case. No court, except the Supreme Court itself, can change it.

This court will not listen to the defendant if it argues that the Supreme Court was wrong in finding invention in the patent in suit on the record before it; *and for the same reason, this court will not listen to the plaintiffs when they argue, as they do argue in this case, that the Supreme Court was wrong in limiting, as it certainly did limit, the scope of the patent in suit to the use of a small fraction of 1% of oil on the ore.*

Defendant does not at this time, and in this place, quarrel with the decision of the Supreme Court in the Hyde case. *It is the plaintiffs who quarrel with that decision.*

In its decision the Supreme Court said :

“ The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is ‘ critical,’ and *minute* as compared with the amount used in prior processes, ‘ amounting to a fraction of one per cent. on the ore ’ (p. 265).

* * * * *

“ The experimenters were working on the Cattermole ‘ Metal Sinking Process ’ as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. ‘ on the ore.’ It was observed, however, that, as the amount of oleic acid was further reduced and the granulation

diminished, there was an increase in the amount of 'float froth,' which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less 'on the ore' of oleic acid was used (p. 267).

* * * * *

"While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion, there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in this case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success,' yet the investigations preceding were so informing that this *final step was not a long one, and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore,'* and therefore the decree of this court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7, and 12, and that the defendant infringed these claims, but that it is *invalid as to claims 9, 10 and 11*" (p. 271).

Comparing the group of claims which was sustained—to-wit, claims 1, 2, 3, 5, 6, 7, and 12—with the group of claims which was condemned—to-wit, claims 9, 10 and 11—we find that all the claims of both groups were limited in terms to the production of a "froth" by "agitation," and to the separation of the "froth" from the material; but that the claims which were sustained were limited in terms to the use of oil in proportions of *less than 1% of the ore*, while the claims which were condemned were broad enough to cover the use of a "*small quantity*" of oil. The only difference between the claims which were sustained and those which were condemned is, therefore, that the former were, while the latter were not, in terms limited to the use of less than 1% of oil on the ore. Nothing can be plainer, therefore, than that the Supreme Court has decided that the plaintiffs are entitled to a monopoly of the use of oil in the *critical proportions described in the specifications and in the*

proofs in the Hyde case, but that they are not entitled to a monopoly of the use of any larger quantities of oil.

The only question which can arise in construing the decision of the Supreme Court is whether the use of oil in proportions between one-half of one per cent. (0.5%) and one per cent. (1%) falls within the monopoly of the patent. The Supreme Court says, in the passage above quoted, that the "patent must be confined to the results obtained by the use of oil within the proportions *often described in the testimony and in the claims* as 'critical proportions' 'amounting to a fraction of one per cent. on the ore.'" The questions which arise are: What "fraction of one per cent." is here referred to? What "fraction of one per cent." is "often described in the testimony" in the Hyde case as the critical proportions? What "fraction of one per cent." is referred to in the claims as the critical proportions? To answer these questions this court must go to the patent specifications, and to the testimony which was before the Supreme Court to which it referred. It must first ascertain, therefore, what are the "critical proportions" set forth in the patent in suit.

THE CRITICAL PROPORTIONS DESCRIBED IN THE PATENT ARE ONE-HALF OF 1% OR LESS.

In the introductory clause the patent refers to the Cattermole process, in which it says "an amount of oil varying from four per cent. to six per cent. of the *weight of the metalliferous matter present*" is employed. Simple arithmetic teaches us that 4% of the weight of the metalliferous matter in any ore which assays 25% metalliferous matter would be 1% on the ore (and an assay value of 20% is exceptional), so that 4% on the weight of the metalliferous matter in all ores assaying less than 25% would be "a fraction of one per cent." on the ore.*

The specification continues (p. 1, line 28) :

"We have found that if the proportion of oily substance be *considerably reduced*—say to a fraction of one per cent. on the ore—," etc.

* Plaintiff's expert in the Hyde case, Dr. Chandler, admitted that the Cattermole oil proportions applied to the tailings at the Broken Hill mine where the process was practiced, called for the use of only 1.2% to 1.8% on the ore (Tr., Vol. III., p. 882).

The specifications say, in the example given beginning at page 1, line 70, that (p. 1, line 79) :

“ To this is added a very small proportion of oleic acid (say from *0.02 per cent. to 0.5 per cent. on the weight of ore*).”

Again they say, page 1, line 96 :

“ The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be *under 0.1 per cent. of the ore* ; but this proportion has been found suitable and economical.”

We, therefore, see that the “critical proportions” referred to by the Supreme Court are defined in the examples contained in the specifications as being between *one-half of one per cent. (0.5%) and one-fiftieth of one per cent. (0.02%)*, the preferred amount specified being *one-tenth of one per cent. (0.1%)*.

THE CRITICAL PROPORTIONS “OFTEN DESCRIBED IN THE TESTIMONY” IN THE HYDE CASE ARE LESS THAN ONE-HALF OF ONE PER CENT.

Turning now to the record in the Hyde case, we find that the testimony referred to by the Supreme Court as defining the “critical proportions,” to which the patent has been by it limited, is as follows :

In “Complainant’s Exhibit Higgins’ Report of March 16, 1905” (Tr., Vol, III., p. 1109) the following appears :

"DETAILS OF EXPERIMENTS."

Acid.	Oleic Acid.	% of Oleic	Time	Temp.	Remarks
1.1%	15 cc.	3 % on ore	4 min.	30.5° C.	Very little float.
"	7½ cc.	1.5 % " "	4¼ "	31 "	Rather more float.
"	5.2 cc.	1.04 % " "	6 "	31 "	Still more float.
"	3.1 cc.	0.62 % " "	6 "	32 "	
"	1.6 cc.	0.32 % " "	7 "	31 "	Float vastly increased.
"	0.5 cc.	0.10 % " "	8 "	31 "	Float vastly increased.
"	0.5 cc.	0.1 % " "	4¾ "	29 "	Not finished.
"	0.4 cc.	0.8 % " "	6½ "	30.5 "	
"	0.5 cc.	0.1 % " "	8 "	31 "	
"	0.5 cc.	0.1 % " "	8 "	31 "	Weight of concs. 170 gms.
"	0.2 cc.	0.04 % " "	8 "	32 "	Apparently not much different.
"	0.1 cc.	0.002% " "	12 "	32 "	Little worse.
"	none	none	7 "	32 "	Very little float.
"	none	none	10 "	32 "	More froth.

Plaintiff's witness Dr. Chandler said in answer to x-Q. 42 (Tr., Vol. II., p. 182):

"The inventors simply state, referring to the Cattermole patent which has just been previously discussed, that four to six per cent. of the weight of metaliferous matter present is employed, that they have found that if the proportion of oily substance be considerably reduced, say to a fraction of one per cent. on the ore, granulation ceases to take place. What this fraction of one per cent. is, they do not mention. *The only way in which I can interpret this fraction of one per cent. is by referring to other portions of the specification, where this fraction of one per cent. is expressed in figures; for example, at line 81 of page 1 of the specification is the following statement, speaking of the ore:*

"'To this is added a very small proportion of oleic acid (say from 0.02 per cent. to 0.5 per cent. on the weight of the ore).'

"That is, from 1/50 of one per cent. up to one-half of one per cent."

Again, in answer to x-Q. 46 (Tr., Vol. II., p. 185), he said:

"These extremes represent from .4 of a pound per ton of ore to 10 pounds per ton of ore.* The patentees do not state on what particular condition of the ore

* 0.4 lbs. per ton is 0.02% and 10 lbs. per ton is 0.5%.

this variation of quantity depends, whether it depends upon the percentage of zinc in the ore or some other quality, but they do indicate that the selection of quantity *between these extremes* must rest with the person familiar with the art who practices the process and it is fair to assume that such person would decide how much oleic acid to use by the results of the simple preliminary tests suggested by the patentees."

An additional quotation from Dr. Chandler's testimony in the Hyde case, which should be read here, will be found in this brief *infra*, page 40.

Plaintiffs' witness Ballantyne testified as follows (Tr., Vol. II., p. 370) :

"I have seen the agitation-froth process carried out many hundreds of times. I have also seen investigations of the process making wide variations step by step in the factors which I have referred to above, and I have myself, on many occasions, carried out these investigations and I now know that if the instructions which Messrs. Sulman, Picard and Ballot drew up in February, 1905, are carried out, namely, to use a slimy pulp, acidified with say .5 per cent. of sulphuric acid, to heat the pulp say to 30° Centigrade and then to agitate it violently with proportions of oil beginning at fifty pounds of oil per ton of ore* and repeating this test, reducing the quantity of oil step by step down to the *vanishing point*, it is inevitable that the agitation-froth shall be produced when the *quantity of oil is diminished to the limits set forth in the patent in suit*, and that a particularly good froth and efficient concentration is obtained when the proportion of oil is about *0.1 per cent. on the ore*, the percentage recommended in the patent in suit as being suitable and economical."

In answer to x-Q. 102 he said (Tr., Vol. II., p. 449) :

"In my opinion the operation of the agitation-froth process *is defined in the clearest possible terms in the patent in suit*, and this remark applies particularly to the *quantity of oil to be used*."

Further along in the same answer he said :

"I have never seen the agitation-froth process successfully carried out by the use of an amount of oil equal to practically one per cent. by weight on the ore,

* 50 lbs. per ton is 2.5%.

and in my opinion 0.9999 per cent. of oil would not be a proper quantity (that is to say, it would not be a suitable and economical quantity), as contemplated by the patent, and would not therefore be a suitable fraction of one per cent. as contemplated by the patent" (Tr., Vol. II., p. 450).

Ballot, one of the patentees of the patent in suit, answering Q. 45 (Tr., Vol. IV., p. 1728), said :

"The only way to carry out the process is that of applying the *proportions of oil set forth in the patent*, but to determine, as all practical men will do, which of the proportions, *within the range*, yield the best result, the characteristic nature of the froth is always an indicator which will of itself tell an experienced operator when the best conditions have been attained, * * *"

Sulman, one of the patentees of the patent in suit, examined as a witness for defendant, in answer to Q. 33 (Tr., Vol. IV., p. 1614), said :

"When we decreased the amount of oil to about .6 per cent. upon the ore, granulation had ceased to appear and a very considerable proportion of mineral was found to float to the surface as a thick froth. We still further decreased the amount of oil until we found that with .2 to .1 per cent. of oil on the ore *practically the whole of the mineral came to the surface as a thick blackish matted froth.*"

Again the same witness testified (Tr., Vol. IV., p. 1654) :

"Q. 120. Then, it might be, that an operator following what you have termed the synthetic mode of regulation might not know whether he was adding oil or acid within the proportions set forth in the patent in suit ?

"A. It might be so, for the space of a minute or two ; as to the acidity, this can be determined instantly by means of Litmus paper, or other suitable indicator, it only being necessary to have a slight degree of acidity present in the pulp. As to oil, the proportions specified in the patent do not need extremely fine adjustment. When the generally minute quantities of oil to ore are considered, which amount *in practice, roughly, to about two pounds per ton of ore** in a great num-

* 2 lbs. per ton is 0.1%

ber of cases, or perhaps somewhat less or more, conditions of ore supply may fluctuate to some extent without greatly affecting the result. If these fluctuations in supply are excessive, then the operator would naturally make such further *slight adjustment* of his oil addition as would meet the altered circumstances."

Picard, one of the patentees of the patent in suit, examined as a witness by the defendant, testified as follows (Tr., Vol. IV., p. 1684) :

"Q. 9. In the patent in suit, No. 835,120, in an example of the application of the process the amount of oleic acid used in that instance is specified as from .02 to .5 per cent. on the weight of ore, the latter quantity being twenty-five times the former. How would an operator practicing the process determine between these wide limits what quantity of oil to use ?

"A. As a matter of fact, *both quantities mentioned are so minute* in relation to the proportion of ore that it is *hardly right to describe the limits as very wide*, but the operator would have no difficulty in determining, if there was any marked difference, which was the best quantity to use, by simply noting whether he was obtaining the specific frothing phenomenon which the patent indicates as being that required."

Further he testified as follows (Tr., Vol. IV., p. 1706) :

"Q. 81. At the time the process which the patent in suit purports to set forth was first exhibited to you, I take it that you were not then for the first time made cognizant of the possibility of using *so small a quantity* of oil as had been used, or that you then first became cognizant of the utility of beating air into the pulp ; am I right in this ?

"A. I had no idea prior to this, that by reducing the quantity of oil to the *limits which were used in this experiment* that such a result would be obtained. I, of course, knew that air would float mineral, previously oiled, but it was not anticipated by me hitherto that this particular result would be obtained if air were beaten in, in the manner in which it was done in making this test. The result of the operation as a whole was an entire revelation to me, and though I knew that work was being carried out on the reduction of the quantity of oil, I never for one moment anticipated in my mind, as being likely to occur, what in fact actually did occur."

Ballot, one of the patentees of the patent in suit, examined as a witness by defendant, testified as follows (Tr., Vol. IV., p. 1724) :

“ Q. 34. And when you saw the work in progress from March 1, 1905, onwards, as referred to by you in your answer to question 29, was this the first occasion upon which you had been informed as to the use in an oil flotation process of the intentional beating in of air for the purpose of promoting flotation ?

“ A. The intentional beating in of air to produce or promote the flotation of froth which was developed by that process was certainly not known until the fact had been actually discovered that by using a *very small quantity of oil, say .2 or .1 per cent.*, and agitating it for a certain time, and then leaving the mixture to stand that the whole froth rose to the surface. * * *

In answering Q. 42 (Tr., Vol. IV., p. 1726), Ballot stated :

“ Q. 42. The patent in suit gives a range of quantity for the oleic acid to be used extending from .02 to .5 per cent. in the example set forth in the paragraph beginning at line 70, page 1, the larger quantity being twenty-five times the magnitude of the smaller. In carrying out this process how is the determination to be made as to which of these widely differing quantities is to be used ?

“ A. Starting with the small quantity, say at the rate of *one pound per ton of ore*,* an operator can soon tell by the appearance as to whether the characteristic froth is produced or not. Guided by appearances he would either increase or decrease the quantity of oil or oleic acid until the cauliflower or characteristic froth was produced, which in itself will be an unfailing index as to whether or not proper conditions have been attained, and he need only then repeat the measurements quantitatively of oil or oleic acid added to his pulp * * *.”

Higgins, one of plaintiffs' engineers, examined as a witness by defendant, stated, as his testimony was put in narrative form in the Supreme Court transcript, in answer to

* 1 lb. per ton is 0.05 per cent.

a question as to what was the "first occasion upon which you ever saw a part of the constituents of the ore, which, in the form of pulp had been oiled, floating upon the surface of the pulp" that :

"In all the slide machine tests that I have conducted I have *never had to use quantities of oily reagents outside of those mentioned in the patent in suit.* The greatest amount of oil that I have ever used in practice is *four pounds per ton of ore,* and the smallest amount I have ever used in practice is *one pound of oil per ton of ore.*" *

Plaintiffs' witness, Dr. Liebmann, testified as follows (Tr., Vol. III., pp. 709, 710) :

"They inform the world what they consider the limits of their proportions, and they add that in their experience *0.1 per cent.* of oil of the amount of ore has been found 'suitable and economical.' Surely one cannot demand more, and even a metallurgist of very low qualifications cannot fail to determine with the greatest ease what quantities will give him the desired results."

The foregoing is the testimony to which the Supreme Court refers in its opinion, where it says "the patent must be confined to the results obtained by the use of oil within the proportions *often described in the testimony * * * as 'critical proportions.'*"

What were the "critical proportions" "often described in the testimony" to which the Supreme Court has in terms limited the patent in suit? The answer is: They were less than one-half of one per cent. (0.5%) of oil on the ore. It is to these proportions that the Supreme Court has limited the patent in suit. In other words, the "fraction of one per cent." of the claims is *that fraction of one per cent. which is half of one per cent. (0.5%) or less.* Any quantity of oil greater than one-half of one per cent. (0.5%) on the ore is not within the scope of the patent as construed by the Supreme Court.

This construction of the patent was not only justified by the testimony in the case, but it was directly invited by plaintiffs' counsel in argument

* 4 lbs. per ton is 0.2% and 1 lb. per ton is 0.05%.

PLAINTIFFS' COUNSEL TOLD THE SUPREME COURT THAT THE CRITICAL PROPORTIONS WERE LESS THAN ONE-HALF OF ONE PER CENT. AND THAT THE USE OF MORE THAN ONE-HALF OF ONE PER CENT. OF OIL WOULD NOT INFRINGE THE PATENT.

Plaintiffs' counsel, Mr. Kenyon, in reply to questions put by Mr. Justice McREYNOLDS and Mr. Justice PITNEY, said (printed report of argument before Supreme Court, p. 85; Deft.'s Ex. 229, Vol. IX., p. 5306):

"MR. JUSTICE McREYNOLDS: I would like to ask you when in this process of reducing oil your invention came into existence?"

"MR. KENYON: *At about one-half of one per cent. of oil.*

"MR. JUSTICE McREYNOLDS: Before you got to the one-half of one per cent. did you have any invention?"

"MR. KENYON: We were passing from the region of Cattermole, which was a distinct—

"MR. JUSTICE McREYNOLDS: *I want to know when your invention came into existence?*

"MR. KENYON: This invention was *not reached*, I should say, from those figures, until *about .5, that is, one-half of one per cent., of oil was reached.*

"MR. JUSTICE McREYNOLDS: At one per cent. you had no invention?"

"MR. KENYON: *No.*

"MR. JUSTICE McREYNOLDS: At one-half of one per cent. you did have invention?"

"MR. KENYON: *It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.*

"MR. JUSTICE McREYNOLDS: WHEN THIS FLOAT HAS MORE THAN ONE-HALF OF ONE PER CENT. OF OIL IT DOES NOT INFRINGE?"

"MR. KENYON: IT DOES NOT INFRINGE.

"MR. JUSTICE PITNEY: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation.

"MR. WILLIAMS: *Absolutely no.*

"MR. KENYON: *It would not.*

“ MR. JUSTICE PITNEY : I understood him to say so yesterday, and I supposed there was something in the record to justify it.

“ MR. KENYON : *Nothing.* That will be a part of my argument.”

Mr. Kenyon said in his oral argument in this case before the District Court (printed report of Plaintiff's Oral Arguments, pp. 66, 67) that nothing was further from his intention in his answers to Mr. Justice McREYNOLDS' inquiries than to limit the claims to one-half of 1% of oil. In view of the proofs we do not see how he could have answered Mr. Justice McREYNOLDS otherwise. But Mr. Kenyon's *intentions* are immaterial. The simple question here is : what were the facts and arguments presented to the Supreme Court as a basis for the decision reached ?

He also said (printed report of arguments before the Supreme Court, p. 91) :

“ It is apparent now that the inventors in their minute one-tenth of one per cent. oil frothing re-agent were really invoking a characteristic and a power of oil in an ore concentration process that *develops only in that relatively microscopic quantity*, and which is defeated and disappears when that minute quantity is even *slightly* exceeded, a characteristic and a power of oil which had not existed in the prior oil concentration processes of the art, which had never been utilized by anybody for ore concentration, and the very existence of which had not been known or suspected.”

Complainant's counsel, Mr. Williams, in his argument before the Supreme Court (printed report of arguments before the Supreme Court, p. 12), said :

“ The amount of oil that we use is generally one-tenth of one per cent. on the ore ; two pounds of oil to the short ton of ore. Every ore presents its own problem, but for a given ore and a given oil there is a certain *critical* factor. The variations in that factor in practice have been from a *trifle less than one pound of oil to the long ton in the case of the rich ores of Australia to four pounds of oil to the long ton in the case of a lean copper*

ore at the Braden mines in Chile.* Those are the variations of different oils and different ores, and because of those *minute variations* you have the impossibility of saying that this process always uses just so much; but given any ore and given any oil, the evidence shows that *if you add another pound of oil* your metal particles commence to stick together and commence to fall down in granules, and you get into the Cattermole sinking sphere, whereas, on the other hand, if you *diminish* it, you cease to have that selective action which is essential; you do not get any float in particular and you have gangue in it; so that it is *critical* for a given oil and a given ore, but it has variations."

Plaintiffs' counsel, in their reply brief in the Supreme Court, stated, commencing at page 6 :

"It is the astonishing fact that, so far as the record here shows, with every ore the world over to which the process has been applied and with all the varying conditions of use, the *largest quantity ever used has been 4 pounds to the long ton (i. e., less than 2/10ths of one per cent.)*, and that the smallest quantity has been *9/10th of a pound per long ton of ore (i. e., less than 1/2 of 1/10th of 1 per cent.)*."

Additional quotations from plaintiffs' brief in the Supreme Court, to the same effect, will be found in this brief (*infra*, pp. 33 and 34, also p. 70), and should be read here.

We see, therefore, that not only did the witnesses in the Hyde case, whose testimony is referred to by the Supreme Court in defining the critical proportions to which the patent must be limited, confine those proportions to less than one-half of 1% on the ore, but that plaintiffs' counsel emphasized this limitation in their arguments and briefs before the Supreme Court.

We, therefore, confidently submit that in limiting the invention to the "critical" proportions "often described in the testimony," the Supreme Court limited it to that fraction of 1% which is *less than one-half of 1%*, although the claims in terms are broad enough to cover any fraction of 1% (for example, 0.999%), and that *defendant has not infringed when it has used more than one-half of 1% of oil*.

* $\frac{9}{10}$ lb. equals 0.045%; 4 lbs. equals 0.2%.

THE COURT OF APPEALS FOR THE THIRD CIRCUIT HAS CON-
STRUED THE DECISION OF THE SUPREME COURT IN THE
HYDE CASE PRECISELY AS WE CONSTRUE IT.

Since the decision of the Supreme Court in the Hyde case was handed down, that decision has been studied and construed by the Circuit Court of Appeals for the Third Circuit in the Miami case (244 Fed., 752). While the judges composing that Court differed among themselves as to other points, they agreed in construing the Hyde decision, with respect to its rigid limitation of the patent to the use of a small fraction of 1% of oil, precisely as we have construed it.* The following are quotations from the prevailing opinion :

Discussing directly the Supreme Court decision it said (p. 758) :

“The plaintiff maintains that the language of the Supreme Court supports its broad contentions that ‘Whenever the modifying agent of the patent (oil) is used, a person infringes who gets air into the pulp in any fashion and agitates the mixture by any means to a sufficient extent to cause the mineral particles to attach themselves to air bubbles and to rise therewith above the top of the mixture in a collection of bubbles and metal particles, to-wit, froth.’” * * * “Considered in the light of what the Supreme Court said and what it did not say, it is clear that the positions of both parties are extreme. The contention of the plaintiff at least omits the *very definite* limitation of the patent to the results obtained by the use of oil *within the described proportions*, and also the equally definite disclosure of an agitation in violence and duration greater than before employed * * *”

* It will, of course, be understood that in this brief we are not dealing with the complete interpretation given by the Supreme Court to the patent in suit, or its complete statement as to wherein the invention of the patent in suit consists. The complete statement includes not only the presence of the “critical” proportion of oil (with which this brief chiefly deals), but it includes also an “agitation greater than and different from that which had been resorted to before,” and the “resulting froth concentrate so different from the products of other processes.”

Still, discussing the Supreme Court decision, it said (p. 759) :

“ We are inclined to the opinion that by this expression the court intended a limitation only upon that one feature of the patent to which the expression was addressed. The District Court had held valid certain claims in which the proportion of oil was described simply as ‘ a small quantity,’ and the Supreme Court, in reversing that finding and holding those claims invalid, used the quoted words of limitation in confining the patent to the results obtained by the use of oil in the *critical proportions of less than 1%.*”

Further on in its opinion it said (p. 760) :

“ The affinity of oil for metal was known, and, though old, was employed in the invention ; but that this affinity in a given condition is greatest when its quantity is relatively least, or that the affinity increases with the *decrease of oil below a given quantity (less than 1%), is the SOUL of the discovery and was wholly new.*”

Judge BUFFINGTON, in his dissenting opinion, after quoting from the Supreme Court’s decision, said, page 776 :

“ It will thus be seen that, first, the *quantity of oil*, secondly, the character of agitation, and, thirdly, the resultant froth, constituted the disclosure.”

We see, therefore, that the Court of Appeals for the Third Circuit has unanimously construed the Supreme Court decision as we have construed it.

DEFENDANT NOT ONLY DOES NOT USE THE “ CRITICAL ” PROPORTIONS OF OIL TO WHICH THE SUPREME COURT HAS LIMITED THE PATENT ; BUT IT DOES NOT OBTAIN THE RESULTS WHICH CAN BE OBTAINED BY THE USE THEREOF.

This Court in its opinion in the Hyde case reviewed the prior art and found that the use of oil in various quantities down to 1% on the ore was old and was known to the patentees of the patent in suit. This finding was in no way disturbed by the Supreme Court. On the contrary, because

it was accepted by the Supreme Court that Court held that claims 9, 10 and 11, which cover the use of a "small quantity" of oil, are invalid; and it held that to be valid the claims must be limited to the use of oil to the "critical proportions", "amounting to a fraction of 1% on the ore."

The Supreme Court differed from this Court only in holding that the superior results obtained by reducing the quantity of oil to a fraction of 1% constituted patentable subject-matter.

The defendant does not use a fraction of 1% of oil, and it does not obtain the results which could be obtained by the use thereof. Thus, in the brief for plaintiffs in the Court below, the following appears* (pp. 107 to 111):

"That defendant's practice employing 20 pounds or more of oil is metallurgically and financially inferior to its former practice is also clear on the record.

"Mr. Wilding, at Vol. VIII., p. 4642, Q. 136 *et seq.*, and in Plaintiffs' Exhibit 272, institutes a comparison between the last quarter of 1916 and the first quarter of 1917, based upon the figures given in the monthly statements filed by the defendant under order of Court entered in this case on November 15, 1913, those monthly statements from January, 1916, down to and including March, 1917, being Plaintiffs' Exhibits 257 to 271, inclusive. Mr. Wilding shows (Vol. VIII., p. 4645, Qs. 155 to 157) that whereas the zinc recovery for the last quarter of 1916 was 92.941%, it was only 83.110% for the first quarter of 1917, and whereas the average grade of concentrate for the last quarter of 1916 was 53.254% in zinc, it was only 47.228% for the first quarter of 1917. He also shows (Vol. VIII., p. 4646, Q. 162) that whereas in the last quarter of 1916, 19.11 pounds of zinc ran to waste in the tailings for every ton of ore fed to the flotation plant, 43.22 pounds of zinc ran to waste in the first quarter of 1917; and that whereas for the last quarter of 1916 the tailings that ran to waste assayed 1.24% of zinc, the tailings that ran to waste averaged 2.789% of zinc for the first quarter of 1917 (Vol. VIII., p. 4647, Q. 163). He also shows (Vol. VIII., p. 4647, Qs. 164-171) that whereas the total

* The references in the brief in the District Court were to the type-written record. These have been changed to refer to the corresponding pages of the printed transcript of record.

cost of the concentration operation for the last quarter of 1916 was a little over 82 cents per ton of ore delivered to the plant, the cost for the first quarter of 1917 was \$1.34 per ton of ore. Thus it appears that the operations during the first quarter of 1917, as compared with the last quarter of 1916, lost more of the values in the tailings, achieved a lower grade of concentrate for the smelter, and cost more in the mill. It cost more to achieve less" (Vol. VIII., p. 4648).

* * * * *

"These two periods were chosen as the nearest together in point of time and therefore the closest approximations to each other in the matter of mill development in process and machinery.

"There was a small difference, however, in the average grade of the ore delivered to the plant during the two periods, that during the last quarter of 1916 showing in zinc 13.446%, and that for the first quarter of 1917, 12.793%. To eliminate this as much as possible as a disturbing factor, Mr. Wilding (Vol. VIII., p. 4648, Qs. 173, *et seq.*), made a comparison of each one of the three months of the first quarter of 1917 with that particular month of the year 1916 that was substantially identical with it in the grade of the ore fed to flotation, the comparison being set out in Plaintiffs' Exhibit 273; and this comparison does not stop with the matter of cost but is carried out to show the comparative profit of the two contrasted practices, assuming a sales value of concentrates on equal terms and in accordance with actual market conditions, as shown in Appendix A to said Exhibit 273, and explained by the witness. This method of comparison selected January, 1916, for contrast with March, 1917; June, 1916, for contrast with February, 1917; and November, 1916, for contrast with January, 1917. The results may be briefly set out as follows:

As to grade of concentrate in zinc (Plaintiffs' Exhibit 273, Column 6) for January, 1916, it was 54.593% as against 47.207% for March, 1917; 54.579% for June, 1916, as against 45.639% for February, 1917; and 53.524% for November, 1916, as against 48.820% for January, 1917.

"As to zinc recovery (Vol. VIII., p. 4651, Qs. 187-192) for January, 1916, 93.117% as against March, 1917, 85.228% for June, 1916, 93.972% as against February, 1917, 81.155%; November, 1916, 92.929% as against January, 1917, 82.858%.

"As to zinc running to waste in the tailings (Vol. VIII., p. 4652, Qs. 198-202) for every ton of ore treated 19.23

pounds of zinc ran to waste in January, 1916, as against 36.90 pounds in March, 1917; 15.65 pounds in June, 1916, as against 48.95 pounds in February 1917; and 18.39 pounds in November, 1916, as against 44.30 pounds in January, 1917. The percentage of zinc in the tailings (Vol. VIII., p. 4653, Qs. 204-208), was in January, 1916, 1.093% as against 2.382% in March, 1917; for June 1916, 1.007% as against 3.183% for February, 1917; and 1.187% for November, 1916, as against 2.838% for January, 1917.

"As to cost of operation (Vol. VIII., p. 4654, Qs. 214-216) the difference in favor of the earlier period in each case was 70 cents per ton of heading in January, 1916, over March, 1917; 56 cents in June, 1916, over February, 1917; and nearly 57 cents in November, 1916, over January, 1917.

"As to the sales value of the concentrates produced, figured on the basis of equal terms and as set out by Mr. Wilding in his Appendix A to Exhibit 273 (Vol. VIII., p. 4658, Q. 245), a difference in favor of the earlier period in each case is shown, namely of \$65,417.00 in January, 1916, over March, 1917; of \$121,526.00 in June, 1916, over February, 1917; and of \$104,599.00 in November, 1916, over January, 1917.

"As to the ultimate profit per ton of heading (Vol. VIII., p. 4659, Qs. 252-254), the difference in favor of the earlier period in each case is \$1.60 per ton of heading in January, 1916, over March, 1917; \$2.05 per ton of heading in June, 1916, over February, 1917; and \$1.81 per ton of heading in November, 1916, over January, 1917.

"As a final conclusion (Vol. VIII., p. 4650, Qs. 256-258 and Note on Plaintiff's Exhibit 273), Mr. Wilding says that the figures indicate that the modification of the operation by the use of excess oil would cause a decrease of profit from the zinc alone of about \$1.75 per ton on all ore delivered to the flotation plant, that the capacity of the mill has by the change been reduced, and that to keep up the tonnage capacity it would be necessary to provide more equipment in the mill. He points out also that the silver loss is somewhat greater, and that with the market price of spelter at 9½ cents, which is conservative, the decrease of profit on one year's treatment, say on 580,000 tons, would be about \$1,015,000.

"Mr. Wilding's work in this regard is purely arithmetical and is accurate. It has not been criticised by any witnesses for defendant, nor have his conclusions been criticised."

It will be seen, therefore, that according to plaintiff's own figures defendant has sacrificed *about a million dollars a year* in recoveries and added expenses in avoiding trespass upon the rights of the plaintiffs, as they have been defined by the Supreme Court; and that, therefore, the defendant not only does not use the "critical proportions" of oil to which plaintiffs' patent is limited, but it is not obtaining the results which could be obtained by the use of such "critical proportions".

What the Supreme Court sustained the patent for is the difference between the results produced by the use of a fraction of 1% of oil and the results produced by the use of larger quantities of oil.

When the Supreme Court condemned the claims which were broad enough to cover the use of any "small quantity" of oil, it was fully advised of the fact that using larger quantities of oil than 1% would produce a metal-bearing froth which differed from the froth produced by the use of a small fraction of 1%, only in that the former contained more oil and gave inferior results. Concerning this froth, plaintiffs said that it was "*A froth*", but was not "*THE froth*". Defendant's froth, being obtained by the use of more than 1% of oil, is necessarily more oily than one produced by the use of a small fraction of 1%; and, as we have seen, plaintiffs' counsel admit it produces inferior results. Defendant's froth is, therefore, the froth which plaintiffs themselves in the Hyde case told this Court and the Supreme Court was not *THE* froth of their patent.

As we shall now show, both sides agreed in the Hyde case that a metal-bearing froth can be produced by the use of more than 1% of oil. Defendant's witnesses testified in the Hyde case that in an experimental apparatus a highly useful mineralized froth could be produced by the use of quantities of oil many times 1% on the ore. This fact was nowhere denied by plaintiffs. All plaintiffs said was that recoveries as high as those obtained in *experimental apparatus* could be obtained in *mill operations*. Plaintiffs, indeed, admitted that recoveries substantially as high as those claimed for their process in the specifications of the patent in suit could be obtained, and had been obtained by them, in mill operations, with the use of more than 1% of oleic acid, the specific oil men-

tioned in the patent in suit. Concerning these froths, plaintiffs said in substance: "We admit they are *metal-bearing froths* but they are not OUR froth. OUR froth is a *dry froth*, is one which is obtained by the use of the *most economical quantity* of oil, and is one which contains the *maximum* amount of metal. These froths produced by the use of more than 1% of oil are *oily* are *wasteful of oil* and contain *less metal*. They are not, therefore, THE froth of the patent."

Thus, Hyde, in the Hyde case, described a series of tests using oil above 1% on the ore. In one test he used 32.4 pounds of oleic acid per ton, which would be a little more than 1.5% (Tr., Vol. IV., p. 1406). In another, he used as much as 72 pounds of straight cotton-seed oil per ton, which is 5.6% (Tr., Vol. IV., pp. 1406 and 1407). In both cases he obtained a highly mineralized froth and good recoveries. Samples of the ores used and a duplicate of the machine used were furnished to the plaintiffs (Vol. IV., p. 1435, x-Q. 105; also p. 1437; also pp. 1570 and 1571). The results of these tests were never questioned by plaintiffs' witnesses.

So also defendants' expert, Dr. Byrnes, testified to certain experiments made by him with different large quantities of oil (Vol. IV., pp. 1528 to 1530). He used more than 3.6% of cotton seed oil in one experiment; and the same amount of olive oil in another experiment; and the same amount of oleic acid in another experiment; and one-half the quantity of oleic acid (to wit, 1.8%) in another experiment. In all cases he obtained a highly mineralized froth and good recoveries.

These facts were not denied or questioned by plaintiffs' experts in the Hyde case. All that plaintiffs' experts said was, that these high recoveries obtainable on an *experimental machine* could not be duplicated in *mill operations*.*

While plaintiffs' witnesses denied that as good recoveries could be obtained in mill operations as were obtained in

* Although plaintiffs' witness Chapman admitted (Vol. II., p. 282, Q. 109):

"The results produced by the agitation-froth process in practice have been on every occasion that has come under my own personal observation, an *improvement* on the result obtained in the slide machine."

slide machines when using large quantities of oil, they did not deny that, even in mill operations, a copious mineralized froth could be obtained thereby which effected concentration. All they contended was, that the froth was more "oily" and not as "dry" as the froth produced by the use of a small fraction of 1%, and that it did not produce as *high recoveries* as could be produced by the use of a small fraction of 1%. They said it was an "oil froth" and not an "air froth," and they said it was not, therefore, *THEIR froth*.

For example, plaintiffs' expert Chapman (Vol. III., p. 939, Q. 250), used in a plant 1.8% *straight oleic acid*, and obtained a froth recovery of 69.78% zinc, and 70.40% lead. While this is not as good a recovery as Hyde and Byrnes obtained in their slide machine experiments above referred to, yet it was a very good result, as is indicated by the fact that the patent in suit only claims for the process a recovery of "about 70% to 80%" (p. 1, line 105).

So, Higgins reproduced in a plant Dr. Byrnes' experiment, using 3.6% *straight cotton-seed oil* (Vol. III., pp. 929, 930), and obtained a "copious" froth which "though oily in appearance *when closely examined*, did not differ in appearance from the usual agitation froth at a *distance of a few feet*." It is true that Higgins did not get as high recovery as did Byrnes, but that is beside the point. The point is, he admits that a mineralized froth was produced and a grade of concentrate which was 47.50% was obtained by the use of 3.6% straight cotton seed oil. Admitting that this froth was more oily than a froth produced with a small fraction of 1% of oil (as, of course, it must have been), and admitting his contention that the recovery when using 3.6% was less than when using a small fraction of 1%, the fact remains that he admits that froth concentration can be produced by using straight oils in quantities above 1% on the ore; and this fact was before the Supreme Court when it condemned as too broad claims 9, 10 and 11.

The view advanced by plaintiffs' expert Dr. Liebmann, which was evidently adopted by the Supreme Court, is that the froth produced by the use of an excess of oil above the minute and economical proportions set forth in the patent, is not *THE* froth of the patent in suit. Concerning the

experiments of Dr. Byrnes above referred to, Dr. Liebmann said (Vol. III., p. 678) :

“ He then used the same process with very much larger quantities of oil and states again that he obtained a froth. There may be what is *popularly called a froth*, but this froth differs in characteristic qualities from THE froth produced with the quantities of oil described by the patentees of the patent in suit as suitable and economical. It contains large quantities of oil which are quite visible and can even be detected by the touch. The appearance of the minerals is changed. They have a dull look and lack the metallic luster of minerals. The agitation froth produced with the quantities of oil which the patent in suit informs you are suitable, does not disclose the presence of any oil. The faint traces of oil which must be there are absolutely invisible and only a careful chemical analysis can show their presence. To the touch the concentrates thus obtained are the same as the ordinary mineral which had never been treated with any oil. I cannot understand why Dr. Byrnes produced these experiments. He only proves that he can produce, with much larger quantities of oil than are considered economical by the patent in suit, *a froth*, but at the same time he proves that the quantities recommended as economical in the patent in suit are economical.”

Further he said (Vol. III., p. 828) :

“ A. I have myself not made such an experiment and I am not speaking from personal experience. I am of opinion, as I stated, that if a froth is produced with quantities of oil such as are used in four or five experiments, it must lack some of the characteristics of THE agitation froth ; that is, for instance, it would not show the metallic lustre and would be oily.”

Further he said (Vol. III., p. 837) :

“ A. I have seen many times concentrates produced even with much smaller quantities of oil than used by Dr. Byrnes, and in each case I found the appearance greatly different from the appearance of THE agitation froth. Even quantities *as small as 1.5 per cent.* alter the look of the mineral particles.”

In using more than 1% of oil on the ore, defendant obtains, and must necessarily obtain, a froth which is “ oily ”

compared with the froth which is produced by the use of a small fraction of 1% and, as shown above (*supra*, pp. 21-25), defendant does not, in fact, obtain as good recoveries as it previously obtained when using a small fraction of 1%. Hence, defendant is now doing only what the Supreme Court has said, in condemning claims 9, 10 and 11, it has a right to do.

Judged by the standard which plaintiffs applied to distinguish the froth of the patent from prior-art froths, defendant does not infringe. Defendant's froth is of necessity more *oily* than a froth produced by the use of a small fraction of 1% of oil. It is produced by an *uneconomical* use of oil. It carries *less values*.

That which does not anticipate, if earlier, cannot infringe, if later. To hold that defendant infringes when it uses more than 1% of oil, would be to say that the defendant infringes when it uses prior-art quantities of oil. It would be equivalent to saying that by the issuance of the patent in suit the public has been deprived of the right to continue to do what it had done before these patentees entered the field.

THE DECISION BELOW IN DETAIL.

As we have said, the opinion below (Tr., Vol. I., p. clxxvii) seems to us to be a reaffirmance in all respects of the District Court's opinion in the Hyde case, *including the errors in it which have been condemned by the Supreme Court*. The District Court, we think, erred in not giving sufficient weight to that part of the Supreme Court's opinion beginning with the statement: "While we thus find in favor of the validity of the patent, we *cannot agree with the District Court in regarding it valid as to all the claims in suit*", and ending with declaring claims 9, 10 and 11, covering the use of any "small quantity" of oil, invalid. In fact, the District Court now intimates that the Supreme Court committed error in condemning these claims 9, 10 and 11, for, referring to the fact that the Supreme Court has condemned them, it says (Vol. I., p. clxxxviii, line 17):

"With the later knowledge of this suit it is *doubted whether such would be the decision now.*"

As we have seen, the plaintiffs in the Hyde case, by their witnesses and by their counsel, told the Supreme Court that the invention consisted in the use of a critical amount of oil, and the Supreme Court found such to be the fact. The District Court, however, boldly says such is not the fact. It says (Vol. I., p. clxxix.) :

“The tendency was to attach *prime importance* to *reduction in amount of oil used*, when in fact this is but a *necessary incident* (for which there are substitutes if not equivalents) to the *creation of the infinitude of bubbles that do the work.*

* * * * *

“These ‘critical proportions’ are like those *known to and solved by every child with its pipe and bowl of suds.* Too little soap, the bubbles are few, small, fragile, and break quickly. Too much soap, they flow from the pipe in a torrent, are heavy, and refuse to float. The right amount of soap, the ‘critical proportions,’ his bubbles are large, detach readily and float high, far and for long. So it is with the bubbles in this process (p. clxxxii.).

* * * * *

“It seems clear *neither patent nor decision undertakes to say the process depends upon less than 1 per cent. of oil* or is inoperative with 1 per cent. or more of oil.

“It is true that *in the beginning and during the Hyde suit the patentees inclined to so believe*, or at least believed better results would be obtained with a fraction of 1 per cent. of oil. *Perhaps limited investigation and experience with few ores and oils justified the belief.*” (p. cxxxxvii.).

Indeed, the District Court in this case, instead of being guided by the finding of the Supreme Court, that the essence of the patented process resides in the use of a fraction of 1% of oil, has advanced and adopted a theory of operation, and of the difference between this process and prior-art processes, which is different from and inconsistent with the theory adopted by the Supreme Court; and which new theory, so far as we know, was never suggested by plaintiffs’ witnesses or by their counsel. It finds that the essence of the patented process resides in the creation of an “*infinitude of bubbles*” in the pulp. If plaintiffs’ witnesses or counsel had advanced such a contention, it would have been easy to dispose of it conclusively.

Indeed, plaintiffs' witnesses and counsel have themselves stated in the most explicit manner that in the practice of the old Cattermole process they used the same agitating apparatus, and operated it at the same speed, as in practicing the process at bar. Using the same agitating apparatus and operating it at the same speed must necessarily have beaten into the pulp the same "infinite of bubbles." For example, plaintiffs' counsel in their brief before the District Court in this case (p. 23), said :

"It is the actual fact that the degree of agitation employed by the patentees in and by the use of the Gabbett mixer at the birth of the invention in suit was *identically the same in every respect* with the agitation that they had been employing for the Cattermole process. The *same machine* was used, the *same speed of rotation* was used, the pulp was manipulated in *identically the same way*. There was no doubt of this fact on the face of the Hyde record, as it went up in somewhat abbreviated form to the Supreme Court, but even if that were not so the actual fact has been proved in this case (Higgins, Tr., Vol. VIII., pp. 4533-4, Qs. 354-358). Not only was the *same identical Gabbett mixer* in use in the spring of 1905 both for the Cattermole process and for the process of the patent in suit, and *rotating at identically the same speed*, but this was repeated in Court at the present trial in several demonstrations, * * *

Clearly, therefore, plaintiffs' counsel cannot and do not say that the process at bar differs from the Cattermole process in the number of bubbles introduced into the pulp.

So, also, with respect to the process which Froment communicated to these patentees December 29, 1903, which was seventeen months before the application for the patent in suit was filed, and long before the earliest date alleged as the date of conception of the invention at bar.* A comparison of Froment's Instructions with the early practice of the invention at bar in Australia (where it was first practiced commercially)

* Referring to the Sulman & Picard Report dated March 3, 1905 (Tr., Vol. III., p. 1106), plaintiff's counsel said in their brief below (p. 68): "This is the earliest document describing the invention and fixes the date of invention as between March 3 and March 10, 1905."

shows that precisely the same speed of rotation of the mixers and the same period of agitation was employed, so that the same "infinite of bubbles" must have been present in one case as in the other. In fact, the only difference between the two process is that in one case (Froment) 1% or more of oil was used, and in the other case (patent in suit) something less than 0.1% of oil was used.

Froment's Instructions are found in Volume III, pages 996 to 1003, and the description of the early practice of the invention at bar in Australia is described in the testimony of Wincey, Volume II, pages 506 to 511.

The following references are all to the record in the Hyde case as reprinted in this case :

Froment instructed the patentees to run the mixers at "about 300 revolutions per minute" (Tr., Vol. III., p. 996). In Australia they run the mixers "from 265 to 270 revolutions per minute" (Tr., Vol. II., p. 511, x-Q. 48).

Froment instructed the patentees to agitate the pulp in the mixers "about ten minutes" (Tr., Vol. III., p. 1000). In Australia the pulp was subjected to agitation in the mixers "from 5 to 10 minutes" (Tr., Vol. II., p. 511, x-Q. 49).

Froment, however, instructed the patentees to use from 1% to 2% of oil on the ore up to 15% metalliferous content (Tr., Vol. III., p. 1000); while in Australia they used "from 0.9 to 1.3 pounds per ton," which is about 0.05% (Tr., Vol. II., p. 505, Q. 21).

This testimony conclusively proves that precisely the same "infinite of bubbles" must have been introduced into the pulp by Froment as by the patentees in the practice of the process at bar.

If, therefore, plaintiffs' counsel had advanced in this case (as they did not) the "infinite of bubbles" theory, it would have been easy for us to demolish it on their own proofs.

The Court below found infringement in the use of more than 1% of oil on the theory that :

(1) Since a small fraction of 1% will do the work as well as, or better than 1% or more of oil, all the oil used by the defendant above a small fraction of 1% is useless and wasted, or worse.

(2) Because a larger quantity always includes a smaller

quantity, in using 1% and more of oil defendant uses a fraction of 1%.

(3) By using a fraction of 1% defendant infringes the claims sustained, and it does not escape infringement by using unnecessarily and wastefully and detrimentally a larger quantity.

Our answer is that if this were a case in which the patentees were the first to use oil in any quantity for flotation purposes, the fact that the defendant unnecessarily and uselessly and detrimentally employs larger quantities than those described in the specifications, might not avoid infringement; and in such a case the logic of the decision below might be sound; but, under the particular facts of this case, the logic of the decision below completely annuls the limitations which the Supreme Court has placed on the claims sustained, and directly contradicts the theory on which the Supreme Court sustained the claims which are limited to the use of a fraction of 1% of oil and condemned the claims limited only to the use of a "small quantity" of oil.

That only "minute" and "critical" quantities of oil would produce THE froth of the patent in suit, is a fact reiterated by plaintiffs' counsel throughout their entire brief before the Supreme Court in the Hyde case. Beginning on the very first page of that brief they said:

"The distinctive feature of the invention patented is the employment of air bubbles in co-action with a *minute and critical* amount of oil in a mixture of ground ore and water so as to produce upon the surface of the water a froth containing substantially all of the metallic particles which can be easily flowed off or removed.

"This process was never used before. This result was never obtained before. The process is dependent upon the use of oil in a *minute and critical* amount and thorough aeration. If *more* oil is used, you do not operate the process, and you do not get the result. So also if *less* oil is used the process is not operated and the result is not obtained. By using *other and greater* quantities of oil you operate a different process and you obtain wholly different results. That the *critical* amount of oil characterizing the process is a *minute* amount of oil (varying slightly with different ores and different oils) is merely a fortuitous circumstance. Nevertheless the process is *dependent upon such definite minute* amount of oil."

On page 6 they said :

“ The secret of the invention of the process in suit was the discovery that by the agitation and aeration of an ore pulp (water and finely ground ore particles, the water, when in motion, carrying the ore particles in suspension therein) in the presence of a *mere trace* of oil, such that the metal particles were coated with a thin attenuated coating of oil, *so thin as to be imperceptible to sight or touch and so attenuated as to exhibit none of the known properties of oil*, air bubbles would be produced and controlled and made persistent, that would firmly attach themselves to the metallic particles and by their buoyancy float the heavy metallic particles upward to and through the surface of the pulp, and form above and resting upon the surface of the pulp a floating layer—usually several inches in thickness—of a mineral froth constituted of such air bubbles carrying the metallic particles. This was accomplished in practice by the employment of oil in the *minute proportion of one-tenth of one per cent.* on the ore.”

On page 11 they said :

“ From the above evidence of defendant and other abundant evidence in the record it appears that for a given ore and a given oil, a *definite minute* amount of oil is *essential* to the carrying on of the process ; that *any substantial increase or diminution of this critical quantity* of oil impairs or destroys the process ; and that the production of the peculiar mineral froth characteristic of the process is recognizable by metallurgists skilled in this new art as an infallible indication of the use of the process.

* * * * *

“ The history of the art demonstrates that with the conjoint use of air and oil, flotation-concentration is wholly impracticable unless the *minute* quantity of oil *characterizing* the process in suit is used.”

Here is a case in which the plaintiffs, in order to sustain their patent, told the Supreme Court that the result sought could be obtained only by limiting the oil to “ critical ” and microscopic quantities, and that prior art processes which used larger quantities of oil and which, therefore, necessarily produced a more “ oily ” froth less economically did not anticipate.

This Court found in the Hyde case (and this finding was in no way disturbed, but was, on the other hand, affirmed by the Supreme Court), that Froment gave instructions to the patentee to use as little as 1% on some ores, and that Cattermole described the use of less than 1% on some ores. And yet when defendant uses larger quantities than Froment recommended and Cattermole directed, the Court below has found that it infringes nevertheless, because the excess oil is "wasted". Plaintiffs obtained a favorable decision from the Supreme Court by convincing it that the presence of more than 0.5% of oil on the ore would defeat the process. The Court below has found that it will not defeat the process but will only "waste" oil.

Defendant does not use more than 1% of oil because it cannot use less and obtain more satisfactory results. It uses it because the Supreme Court has said it is not at liberty to use less than 0.5% but that it is at liberty to use more than that. Out of abundance of caution, and dreading the fire like every burned child, defendant has used not only more than 0.5%, but it has used more than 1% of oil on the ore. To respect the property rights of the plaintiff as defined by the Supreme Court is, as we have shown (*supra*, p. 25), costing the defendant in reduced recoveries and increased costs over a million dollars a year. Of course, in one sense it is true that any excess oil above the smallest quantity which will do the work is "wasted." What the Supreme Court has held is, that the soul of this invention is the avoidance of that "waste", with the superior metallurgical results and the less "oily" froth incident thereto. Defendant has not avoided that "waste" with its accompanying disadvantages of lower recoveries and a more "oily" froth, and therefore it has not infringed.

Again the Supreme Court held that the claims of the patent which were broad enough to cover the use of any "small quantity" of oil were too broad and were, therefore, invalid; yet the Court below has, in fact, expanded the claims which were sustained by the Supreme Court so that they cover the use of oil in any quantity *however large it may be*, so long as it will produce a metal-bearing froth. In so doing, it has totally neutralized the decision of the Supreme Court condemning

claims 9, 10 and 11, for, by construction, it has expanded the other claims to fully cover the territory of the condemned claims and more. It has expanded the sustained claims to cover not only the use of any "small quantity" of oil, but to cover the use of even a *large* quantity, on the theory that the oil which is used above a small fraction of 1% is wasted and it is not to be reckoned as the oil of the claims. We submit that any process of reasoning which arrives at this conclusion is essentially fallacious.

Plaintiffs' counsel said in their brief before the District Court in the Hyde case, that claims 9, 10 and 11 were intended to cover a "*wasteful use of oil*"—precisely what they say, and what the Court below has said, the defendant is doing when it uses anything more than a small fraction of 1% of oil. In condemning these claims, therefore, the Supreme Court has said the plaintiff is entitled to cover the use of "minute" and "economical" quantities of oil, but it is not entitled, in view of the prior art, to prevent others employing a larger and "wasteful" amount of oil. Thus, at page 11 of their brief, plaintiffs' counsel said :

" Claims 9, 10 and 11 are the broadest claims. While clearly limited to the new agitation-froth phenomenon, they are not limited as to oil quantities except that the oil must be 'a small quantity.' These claims have a broader scope than has as yet proved to be necessary for the protection of the agitation-froth invention, since no mine owner will use an ounce more of oil than is necessary, and the ores so far tested have not required more than the higher limit of the limited claims, but these claims would cover a *wasteful use of oil* such as defendant has suggested the possibility of."

It was the claims covering the "*wasteful use of oil*" that the Supreme Court declared invalid. Notwithstanding this, the learned District Judge has found in this case that the valid claims cover the "wasteful" use of oil.

Furthermore, the distinction which the Court below makes between a beneficial use and a wasteful use of oil, holding that if the excess above a small fraction of 1% were beneficial it would be no infringement and finding infringement because it is detrimental, ignores entirely the theory on which the

patent was differentiated from the prior art and sustained. He says (Tr., Vol. I., p. cxc) :

“ If the excess oil were effective and useful, and not inert, useless and harmful, it would be without the claims of the patent, would be of that the patentees abandoned to the public, and *would involve no infringement.*”

We show (*supra*, pp. 25-29) that plaintiffs admitted in the Hyde case that a metal-bearing froth could be produced by prior-art quantities of oil. Admitting this, they said that such froths were not THE froths of the patented process, because they were *more oily*, were *not produced economically*, and *carried less metal*. When the defendant now produces a froth using the prior-art quantity of oil, which froth is *more oily* than the froth produced by the quantities of oil specified in the patent, and is *less economical*, and carries *less metal*, the Court below finds that it infringes *for that reason*. So a process which was held not to anticipate because it was more wasteful and less efficient, is held to be an infringement, *for the reason that it is more wasteful and less efficient !*

THE CLAIMS CANNOT BE STRETCHED TO COVER THE USE OF OIL IN MORE THAN THE “CRITICAL PROPORTIONS” BY THE APPLICATION OF THE DOCTRINE OF EQUIVALENTS OR BY ANY OTHER EXPEDIENT.

Cases were quoted in plaintiffs' brief below in support of the proposition that infringement may be found where the letter of the claim is avoided. That proposition is undoubtedly sound, but, like other sound legal propositions, it is surrounded by limitations. If this were not true, claims would be meaningless and superfluous. If this were not true, the provisions of the Statutes (Sec. 4888), which require the patentee to “*particularity point out and distinctly claim the part, improvement or combination which he claims as his invention or discovery*” would be a dead letter.

Plaintiffs cannot by resorting to the doctrine of equivalents, or by any other expedient, wipe out of their patent any limitation which the Supreme Court has imposed upon it.

This case is on all-fours with the case of *Union Metallic Cartridge Co. vs. U. S. Cartridge Co.*, 112 U. S., 624. In that case the patent related to a machine for making cartridge cases. The machine as described in the patent contained a movable die and a stationary bunter. Defendant used a stationary die and a movable bunter, which plaintiff contended was an equivalent, and which ordinarily would be regarded as an equivalent. But as a condition to extending the patent, the Commissioner of Patents had required the patentee by disclaimer to erase the description of a stationary die and movable bunter, which did not appear in the patent as originally issued, but which had been added by a reissue. The Supreme Court, speaking by Mr. Justice BLATCHFORD, said that it did not make any difference whether a stationary die and movable bunter, such as the defendant used, was, or was not, as a matter of fact, the equivalent of a movable die and stationary bunter, such as the patentee described. The facts of the case, the Supreme Court said, were such as to prevent the patentee (p. 645)

“being heard to allege that persons who use machines with a stationary die D and a movable bunter E infringe the claims of the reissue. * * * *The question of fact is not open now* as to whether Allen invented at any time the stationary die D and movable bunter E, or as to whether it was, or is, or could be, a mechanical equivalent for the movable die D and stationary bunter E, because those questions are concluded by the disclaimer.”

The same reasoning applies in this case. Having secured a favorable decision in the Supreme Court on the allegation that a larger amount of oil *is not* the equivalent of the “critical proportions,” plaintiffs will not be “heard to allege” that a larger amount of oil *is* the equivalent of the “critical proportions.” This “question of fact is not open now.”

The allegations of plaintiffs’ witnesses and counsel in the Hyde case and in this case on the central fact as to the quantity of oil which characterized their process are flagrantly inconsistent. In the Hyde case they alleged that the use of a small fraction of 1% produced results which were *essentially different* from those produced by the use of

any larger quantity of oil ; and it was because the Supreme Court believed these allegations that it sustained their patent ; but in doing so the Supreme Court was careful to limit the patent to the use of such " critical proportions " of oil. In this case they allege that the use of larger quantities of oil produce results which are *substantially the same* as those produced by the use of a small fraction of 1% ; and on this allegation they ask this Court to find the defendant an infringer when it uses 1% and more of oil. If they were right in the Hyde case, they must be wrong in this case. If they are right in this case, they must have been wrong in the Hyde case ; and, furthermore, in that event the decision of the Supreme Court was certainly wrong, because it was based on a misapprehension of the central fact of the case. It would produce an intolerable situation if the plaintiffs, after having *sustained* their patent in the Supreme Court on the theory that more than the critical proportions of oil will produce *substantially different* results, should now be permitted to hold defendant as an *infringer* on the theory that they will produce *substantially the same* results.

The Supreme Court, however, has wisely relieved this Court of the burden of considering any question of estoppel. Believing the allegation of our adversaries that only the " critical proportions " described in the specifications and in the testimony of the witnesses would produce THE froth of the patent, and sustaining the patent by reason of that belief, the Supreme Court was careful to specifically and rigidly limit the patent to the use of these proportions of oil. Hence, this Court has only to apply the patent as thus limited by the Supreme Court to the facts in this case, and thus applying the patent it must find non-infringement in the use of any quantity of oil above the so-called " critical proportions " of the Hyde case. What plaintiffs' counsel ask this Court to do is to wipe out the specific limitation which the Supreme Court has imposed on their patent as a condition to sustaining those claims which were sustained.

In condemning claims 9, 10 and 11 the Supreme Court had before it the very argument which is presented to this Court as a reason why it should stretch the other claims to cover defendant's practice when it uses quantities of oil above the

“critical proportions.” In plaintiffs’ main brief before the Supreme Court (p. 55) counsel said :

“Claim 9 is the broadest claim. The amount of oil is stated to be ‘a small quantity.’ The process is stated to include ‘coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth.’ The essentials of agitation of the ore in powdered form diffused in water in the presence of a small quantity of oil, so as to form a froth and thereby to utilize air bubble separation, are set forth, as well as the completion of the operation of concentration or separation by separating the froth. The novelty of the invention as thus defined is unquestionable. *Conditions may well arise in the future wherein the critical oil proportion is increased by reason of a useless absorption of the oil within the pores of a gangue material, or wherein an oil or a mixture of oils is employed having unusual characteristics, as a result of which the critical oil proportion may be one per cent. or slightly more. Under such conditions this and the two following claims may be necessary to protect the invention.*”

Plaintiffs’ expert witness, Dr. Chandler (Tr., Vol. II., p. 208), concerning claims 9, 10 and 11, said in the Hyde case :

“In *claims 9, 10 and 11* no maximum figure is given for the amount of oil to be employed. The expression is simply ‘a small quantity of oil,’ which, as I understand the language of patent literature, would mean a quantity small enough to accomplish the result described and claimed in the patent, the specification of which clearly indicates that, although the quantity may be variable, it is *somewhere about one per cent. or under.*”

“The patentees have selected as the oil to be used in their example oleic acid, and claims 5, 6 and 7 mention this particular oily substance and also mention a proportion which may vary from 0.02 to 0.5 per cent., having evidently found that this is a *sufficient* margin of variation in quantity.”

It was with this argument and this testimony before it that the Supreme Court in effect said: “No; you are not entitled to those claims 9, 10, and 11, because they are too

broad. The full extent of the monopoly you are entitled to is the use of oil in the 'critical proportions.' Beyond these proportions lies the public domain."

In other words, the condemnation by the Supreme Court of claims 9, 10 and 11, in view of the arguments presented on behalf of the plaintiffs, is a direct and final answer to the plaintiffs' contentions in this case.

PLAINTIFF'S THEORIES THAT THE OIL OF THE CLAIMS IS ONLY THAT PART WHICH IS ATTACHED TO THE METALLIFEROUS CONTENT OF THE CONCENTRATES, AND THAT PETROLEUM OIL IS NOT INCLUDED WITHIN THE TERM "OIL," AS USED IN THE SPECIFICATIONS AND CLAIMS, ARE NOT SUPPORTED BY THE FACTS AND WERE NOT ADOPTED BY THE COURT BELOW.

In the Court below plaintiff's counsel argued that the claims sustained by the Supreme Court were infringed by the use of 1% or more of oil, on two theories :

(a) It was contended that in reckoning the amount of oil which is specified in the claims, account only should be taken of the oil which is attached to the metalliferous content of the concentrates.

(b) It was contended that the petroleum constituent of defendant's oil mixture (being 76% of the whole) does not have a "preferential affinity for metalliferous matter over gangue," and is not, therefore, included within the term "oily liquid" as used in the claims.

Neither of these contentions were sustained by the Court below. The contention that only the oil which is attached to the metalliferous content of the concentrates should be taken into account, is so fanciful that it was not even referred to by the District Court in its opinion. The contention that petroleum is inactive and does not have a "preferential affinity for metalliferous matter over gangue" as required by the claims of the patent, was directly held to be unsound. The Court below said (Tr., Vol. I., p. clxxxix.):

"Another (quality of oil) of lesser importance, and which all oils possess is the 'preferential affinity for metalliferous matter over gangue.'"

(a)

The contention that in reckoning the amount of oil which is referred to in the claims, account only should be taken of the oil which is attached to the metalliferous content of the concentrates, is not based on reason, or on anything in the specifications or claims. It is contradicted by everything therein. Claim 1, for example (which is typical), describes the process as consisting in "mixing the powdered ore with water, adding a small proportion of oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth," etc. Clearly what is described and claimed here is the use of a fraction of 1% of oil on the ore *in the mixture which is to be agitated to produce the froth*. Neither the specifications nor the claims make any reference to the amount of oil which attaches itself to the metalliferous content of the concentrates. The only reference in the specifications to the oil attached to the concentrate is the suggestion (p. 2, line 3) that the froth may be "treated with a dilute solution of caustic alkali, which removes the oleic acid in the form of soap."

Mr. Kenyon, in his oral argument in the Court below (printed transcript of Plaintiffs' Oral Arguments, p. 51), put this contention in another way, but in a way which amounts to precisely the same thing. After saying that we must consider as oil in the process only the oil which is attached to the metalliferous content of the concentrates, he said that from the total amount of oil used must be subtracted all the oil which goes off with the tailings; all the oil which is absorbed in the gangue of the concentrates; all the oil which is dissolved in water, etc. This is only saying in a roundabout way that the only oil which is to be counted as the "fraction of one per cent." referred to in the claims is the oil which is attached to the metalliferous content of the concentrates, because when all these things are subtracted there remains only the oil which is attached to the metalliferous content of the concentrates. We have already shown that the specification and claims directly contradict this contention, because the fraction of 1% of oil which is mentioned in them is the oil

which forms part of the mixture which is to be agitated to produce the froth. It is not the oil which is attached to the metalliferous content of the concentrates when the process is completed.

If the fraction of 1% of oil in the ore referred to in the claims is limited to the oil which is attached to the concentrates, then defendant's practice is still further away from the proportions specified in the claims, for Defendant's Exhibit 158 (Tr., Vol. IX., p. 5184) shows that the percentage of oil in the concentrates, when defendant uses more than 20 pounds of oil to the ton of ore, is as much as 1.86% to 2.09%.

(b)

The contention that the petroleum constituent of defendant's oil mixture is inactive and is not included within the term "oil", as used in the patent in suit, is contradicted by the proofs, as the Court below found (*supra*, p. 41).

Defendant has used various mixtures of oils. The mixture used by it during the joint run on April 29, 1917, which may be taken as typical, was, in round numbers, (Deft.'s Ex. 227 ; Tr., Vol. IX., p. 5292), composed of 24% pine oil, 65% fuel oil, which is a petroleum residuum, and 11% kerosene. Since fuel oil and kerosene differ only in specific gravity, both being petroleum, we may simplify the formula by saying that the oil was composed of 24% pine oil and 76% petroleum, or substantially one part vegetable oil to three parts petroleum. The amount of mixture used was 26 pounds per short ton of ore, *i. e.*, 1.3% of oil on the ore.

On behalf of plaintiffs it is contended that petroleum is inert in the process, and should be neglected in determining the percentage of oil on the ore, within the meaning of the claims of the patent in suit. The suggestion is that petroleum was used only as a diluent to increase the bulk of oil without taking any active part in the process of the patent.

This contention raises the question as to what is the "oily liquid" referred to in the claims. Does it include, or does it exclude, *mineral oils*, as the petroleums are?

In the specifications the "oily liquid" of the claims is defined (p. 1, line 12) as "oils, fatty acids, or *other substances which have a preferential affinity for metalliferous matter over gangue.*"

The specification then refers to the Cattermole patent No. 777,273 as describing the use of the same "oily substances" in larger proportions. Turning to that patent we find it states (p. 2, line 89):

"The 'oil' used may be animal, vegetable, or *mineral oil or mixtures of these* or such coal or wood tar products or other substances which exercise, like oils, a *preferential physical affinity for metallic mineral matter as distinguished from gangue.*"

Further on the specifications of the patent in suit say (p. 1, line 62):

"The proportion of mineral which floats in the form of froth varies considerably with different ores and *with different oily substances*, and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine *which oily substance* yields the proportion of froth or scum desired."

When we come to the claims we find that they define the oil as "*an oily liquid having a preferential affinity for metalliferous matter.*"

Hence we see that any oily liquid having a *preferential affinity for metalliferous matter over gangue* is included within the term "oily liquid" in the claim. Since there is no question but that petroleums have such *preferential affinity*, and the Court below has in terms so found (*supra*, p. 41), there can be no question but that they are included within the term "oily liquid" contained in the claims.

The fact is, the practice of using a mixture of vegetable oil and petroleum is not peculiar to defendant, nor is it peculiar to a process in which oil is used in quantity above 1% on the ore. On the other hand, it is a practice which is common with those who use quantities below one-half of 1% on the ore, and who are *operating as licensees under the patent in suit.*

Thus plaintiffs' licensee, the Braden Copper Company, uses a mixture of 1 pound American wood tar oil to 3 pounds of Texas oil (petroleum) per ton of ore (Tr., Vol. II., p. 284). At that place, therefore, where only one-fifth of 1% of oil

on the ore is used, the mixture of oils used is precisely like that used by defendant, to-wit, one part vegetable oil to three parts petroleum.

Again, plaintiffs' licensees at the Consolidated Arizona mine use between 2 and 3 pounds of oil to the ton of ore, about one-half of it being Carolina turpentine, and the other half fuel oil and stove oil, both of which are petroleum (Tr., Vol. VII., p. 4100). At this place, therefore, where only about one-tenth of 1% of oil on the ore is used, the mixture of oils used is one part vegetable oil and one part petroleum.

Again, plaintiffs' licensee, the Anaconda Copper Company, uses for the concentration of sands and slimes *kerosene* acid sludge *alone* or a mixture of *kerosene* acid sludge and creosote in quantities between about 0.13% and 0.33% (Tr., Vol. VIII., p. 4291, Qs. 8 and 9, and Plffs'. Exhibits 313-315, Vol. IX., pp. 5555-6).

Furthermore, the alleged infringers in this country, before they adopted the use of oil in quantity above 1% on the ore, used a mixture containing petroleum as one of its components. This was true of the Utah Copper Company at its Magna plant, and also at its Arthur plant; it was true of the Chino Copper Company; and it was true of the Ray Consolidated Company.

Thus, at the Magna plant of the Utah Copper Company, when using less than 0.5% of oil, they always used a mixture of which petroleum (Jones oil) was a constituent (Tr., Vol. V., p. 2689, x-Q. 268; also x-Q. 281, also x-Q. 286). Since more than 1% of oil has been used, they have continued to use Jones oil as a constituent of the mixture (Tr., Vol. V., p. 2693, x-Q. 289).

Thus, the Chino Copper Company, when using less than 0.5% of oil, always used a mixture of which petroleum (Jones oil) was a constituent. Since more than 1% of oil has been used, they have continued to use Jones oil as a constituent of the mixture (Tr., Vol. V., p. 2422, Qs. 42 to 44).

Thus, the Ray Consolidated Company, when using less than 0.5% of oil, always used a mixture of which petroleum (fuel oil) was a constituent. Since more than 1% of oil has been used, they have continued to use fuel oil as a constituent of the mixture (Tr., Vol. VI., p. 3244).

So, as we have said, the practice of defendant in using a

mixture of vegetable oil and petroleum is not peculiar to it, or to the use of quantities of oil above 1% on the ore.

That petroleum is not, as contended on behalf of plaintiffs, inert in the process, is clearly demonstrated by the mill operations at the Arthur Plant of the Utah Copper Company, records of which appear in Defendant's Exhibit 31 (Tr., Vol. IX., p. 4994), which are explained, Transcript, Vol. V., p. 255, Q. 59 *et seq.* In one run (Experiment No. 7) the oil used was 20.33 pounds per ton, it being a mixture composed of 89% of what plaintiffs' witnesses call inactive oils, that is petroleum (30% Jones fuel oil and 59% smelter fuel oil) and 11% of what they call active oils (10% American creosote and 1% Yaryan pine oil). In this run the extraction was 98.4%, and the tailings carried 0.076% copper. The actual amount of so-called inactive oil used per ton was, therefore (being 89% of 20.33 pounds) 18.1 pounds; and the actual amount of so-called active oil used per ton was, therefore (being 11% of 20.33 pounds) 2.23 pounds. In another run (Experiment No. 20) *substantially the same amount of so-called inactive oil was used alone* (17.84 pounds of a mixture of the same petroleums — *i. e.*, smelter fuel and Jones fuel, in the same proportions). *In this case the extraction was 95.06% and the tailings carried 0.306% copper.* In another run (Experiment No. 17) *substantially the same amount of so-called active oil was used alone* (1.97 pounds of a mixture of the same so-called active oils, that is, American creosote and Yaryan pine, in the same proportions). In this case the extraction was 85.72%, and the tailings carried 0.81% copper. These determinations are not contradicted or questioned, and they prove that the petroleum oil used in this process was by no means inactive or inert. They prove it was, indeed, quite as active and quite as efficient in producing the desired results as was the so-called active oil. Indeed, it will be observed that the petroleum when used alone gave higher extraction than did the so-called active oils when used alone. The highest extraction, however, was attained when they were used together in a mixture, as defendant uses them.

In direct contradiction of the theory of plaintiffs' witnesses that petroleum is an inactive oil and plays no part in the production of foam, Wicks describes what happened one day in the mill of the Chino Copper Co. in the regular course of mill

operations when the supply of petroleum was unintentionally shut off. He says the foam immediately disappeared, and no recoveries were obtained until the supply of petroleum was turned on again. At that time they were using 32.27 pounds of oil per ton of ore (Tr., Vol. V., Qs. 87-91, p. 2433).

See also testimony of Punchon as to the effect of suspending feed of petroleum at the Arthur plant (Tr., Vol. VII., p. 3850, Qs. 8-17).

Furthermore, plaintiff's inventors and expert witnesses admit that petroleum, instead of being inactive in flotation processes, is active and useful.

Thus, in Complainants' Exhibit Sulman & Picard Report of May 3, 1905 (Tr., Vol. III., pp. 1113 to 1125), being the report of the patentees to the chairman of Minerals Separation of the alleged discovery of the invention at bar, they said (Tr., Vol. III., p. 1118) :

" We may here conveniently note that *other oils* besides Oleic acid may be employed in this modified recovery process, but so far as Broken Hill is concerned, Oleic acid gives by far the best results. *Petroleum residuum* added as emulsion, *paraffine oil alone*,* R_3P_1 and R_1P_3 emulsions, have also been used, and all give small proportions of float, but do not act nearly so vigorously or efficiently on Broken Hill ores as plain Oleic acid."

Furthermore, plaintiff's witness Higgins, says that petroleums (fuel-oil and kerosene), when used with a vegetable oil are " useful in the process in the patent in suit chiefly for the purpose of *preventing the coarse mineral from falling out of the froth*" (Tr., Vol. VIII., p. 4738, Qs. 39 and 40) ; that it prevents " showering ", that is, it helps to keep the mineral from falling out of the froth (Tr., Vol. VIII., p. 4606, Qs. 421 and 422).

Furthermore, plaintiff's witness Chapman, says concerning petroleum (Tr., Vol. VIII., p. 4436, Q. 38) :

" I have on many occasions used inactive oils, particularly those like fuel-oil, kerosene and stove-oil to

* " Paraffine oil " is the name by which *kerosene* is known in England. See Tr., Vol. VIII., p. 4740, Q. 50. *Fuel oil, Jones oil, etc.*, being the heavier fractions left in the still after the gasolene and kerosene have been distilled off, are " petroleum residuums."

produce a condition of froth in the Spitz box that will maintain a condition of overflow. The addition of these re-agents in small quantities is *extremely useful* for the purpose, and considerably eases up the operating work."

So it is proved that it is the common practice of those licensed under the patent in suit, and others using less than one-half of 1% of oil on the ore, to use petroleum mixed with other oils in the practice of the process, and it is admitted that the petroleum used is active as an oil—not inactive like "milk or sawdust," as Mr. Kenyon said in argument (printed report Plaintiff's Oral Argument, p. 65)—in effecting the concentration which is the purpose of the process.

Nor is it true, as plaintiffs' counsel stated below, that the production of a froth with more than 1% of oil is dependent on the use of a *mixture* of oils. That a mineral-bearing froth can be produced by the use of more than 1% of *straight oil*, was proved by defendants' witnesses, and was admitted by plaintiffs' witnesses in the Hyde case.

Thus, we have already shown (*supra*, p. 26), that defendant's witnesses in the Hyde case demonstrated that using *straight oleic acid*, or *straight cotton-seed oil*, or *straight olive oil*, in quantities much larger than 1%, highly mineralized froths and good recoveries could be obtained in the laboratory. We have shown that these facts were not denied by plaintiffs' witnesses; that all plaintiffs' witnesses said was that such high recoveries could not be obtained by the use of these oils in mill operations. At the same time, they admitted that recoveries as high as those described in the specifications of the patent in suit could be obtained and, indeed, had been obtained by them, in mill operations, using more than 1% of straight oleic acid (*supra*, p. 27).

It is, therefore, fully established in this case that mineralized froths can be produced by the use of more than 1% of *straight oil* (not a mixture of oils), and that such froths are not distinguishable from the froth produced by a small fraction of 1% of oil except that they are more oily, are produced less economically and do not carry as heavy a load of minerals—all of which features plaintiffs' witnesses, as we have seen (*supra*, pp. 25-29), say are characteristic of defendant's froth when using more than 1% of oil mixture.

THE THEORY THAT THERE IS SOMETHING PECULIAR ABOUT DEFENDANT'S ORE WHICH PERMITS THE USE OF MORE THAN 1% OF OIL IS NOT ESTABLISHED BY THE PROOFS AND WAS NOT ADOPTED BY THE COURT BELOW.

Plaintiffs' witnesses intimate that there is something peculiar about defendant's ore—that it contains an undefined amount of an undefined material, which Greininger called "gangue slime" and which Chapman called "clay gangue"—which makes it possible for defendant to use above 1% of oil—the inference sought to be deduced from this being that but for the presence of the so-called "gangue slime" it would be impossible to practice the process with more oil than given in the examples of the patent. *i. e.*, under one-half of 1%. This testimony is mere speculation and inference, and *being adduced in rebuttal* it could not be replied to directly. It has been, however, sufficiently replied to indirectly by the proofs in the record showing that oil in excess of 1% is being regularly used at other mills than that of the defendant, where there is no suggestion that the ore contains any "gangue slime" (whatever that may mean). The use of oil in excess of 1% on the ore has been, since the decision of the Supreme Court in the Hyde cases, regularly used at the Magna Mill of the Utah Copper Company, as testified to by Conrads (Tr., Vol. V., p. 2655, Q. 129, *et seq.*); at the Arthur plant of the same company, as testified to by T. A. Janney (Exhibit 30, Tr., Vol. IX., p. 4992; also Tr., Vol. V., p. 2549, Q. 34, *et seq.*); by the Chino Copper Company, as testified to by Wicks (Exhibit 26, Tr., Vol. IX., p. 4987; also Tr., Vol. V., p. 2415, *et seq.*), and by the Ray Consolidated Company as testified to by Engleman (Exhibit 44, Tr., Vol. IX., p. 5033; also Tr., Vol. V., p. 2740, *et seq.*). In each case the mill records of the plants, both before and after the use of oil above 1% on the ore was adopted as the regular mill practice, were produced. The facts established by this testimony, in brief, are given in the foot-note.*

* At the Magna plant of the Utah Copper Company the change from below 1% to above 1% of oil on the ore was made on December 25, 1916. Before the change was made, the smallest quantity of oil used was in the month of March, 1915, when the average was 1.23 pounds per ton; and the largest

So we see it is not anything peculiar about defendant's ore—the alleged presence of something nebulously called “clayey gangue,” but not identified by any analysis, although complainants' experts had plenty of defendant's ore to analyze and by which to prove its constituents, if they had seen fit to do so—which enables the defendant to use more than 1% of oil on the ore, because it is proved that at other mills, where the ore is not the same, amounts of oil in excess of 1% are being commercially and continuously used.

As a matter of fact, complainants' witness Chapman admitted that even if there were no “clay gangue” in defend-

quantity used was in the month of April, 1916, when the average was 5.37 pounds per ton (Tr., Vol. V., p. 2648, Qs. 92, 93). Before the change, a mixture of various oils, including petroleum was used. In August, 1915, they used a mixture of Barrett creosote, Barrett No. 4, Jones oil, pine oil, and an oil called No. 642, which is a reconstructed pine oil (Tr., Vol. V., p. 2689, x-Q. 268). In August, 1916, they used a mixture of Jones oil, creosote and waste oil (Tr., Vol. V., p. 2691, x-Q. 281). In December, 1916, before the change was made, they used a mixture of Jones oil and creosote (Tr., Vol. V., p. 2692, x-Q. 286). After the change was made they used a mixture of Jones oil and Yaryan pine oil (Tr., Vol. V., p. 2693, x-Q. 289). Defendant's Exhibits 35 and 36 (Tr., Vol. IX., pp. 5015-5016) give a complete statement of the mill operation before and after the adoption of the use of larger amounts of oil than 1% on the ore. Exhibit 35, which gives averages for the entire period before the adoption of 1% of oil, compared with Exhibit 36, which gives averages for the entire period after the adoption of 1% of oil, show that the extraction before the change was 97.461% and after the change was 98.161%. They show that the copper in the concentrates before the change was 39.294%, and after the change it was 28.458%.

Defendant's Exhibit 38 (Tr., Vol. IX., p. 5020) gives a record of experiments made with varying amounts of a given mixture of oil while other conditions were kept constant (Tr., Vol. V., p. 2662, *et seq.*).

At the Arthur plant of the Utah Copper Company the change from below 1% to above 1% of oil on the ore was made December 21, 1916. A tabulation of the results before and after the change is contained in Defendant's Exhibit 30 (Tr., Vol. IX., p. 4992). Before the change, an average of 3.76 pounds of oil per ton of ore was used, and after the change an average of 21.98 pounds of oil per ton was used. Before the change, the tailings averaged 0.361% of copper; after the change they averaged 0.238% of copper. Before the change, the recovery was 96.57%; after the change, it was 96.60 (Tr., Vol. V., pp. 2552, Q. 46). Both before and after the change they used mixtures containing petroleum oil as one of their ingredients.

At this plant a series of thirteen tests, which were full mill operations, were made using in all the thirteen tests a mixture which was made of 89% petroleum (smelter fuel oil and Jones oil), 10% of creosote, and 1% of Yaryan

ant's ore, still, in his opinion, the same amount of oil now being used could be used, and the same results in recoveries would be obtained—an admission which disposes of the whole matter and shows that it is merely dust injected into the mental atmosphere of the case to obscure the plain facts. Chapman said (Tr., Vol. VIII., p. 4453):

“ x-Q. 109. Now, you have explained the operations at the Butte & Superior which you saw by reference to the clayey gangue slimes you referred to. Is it your

pinc oil. In these tests the quantity of mixture used varied from 6.87 pounds to 96.46 pounds per ton of ore. As the amount of oil was increased from the lower limits, the recovery increased until 25.50 pounds of oil per ton were used. Using oil in larger quantities than 25.50 pounds per ton of ore, and up to 96.46 pounds per ton of ore, still gave excellent results (*i. e.*, 96.39% recovery) although the tailings carried a little more copper, to-wit, 0.272% (See Defendant's Exhibit 31, Tr., Vol. IX., p. 4994, and testimony, Tr., Vol. V., pp. 2562, *et seq.*).

At the mill of the Chino Copper Company the permanent change from below 1% to above 1% of oil on the ore was made December 21, 1916 (Exhibit 26, Tr., Vol. IX., p. 4987; also Tr., Vol. V., p. 2421, Q. 35), although they had for three days in November, 1916, used as much as 23.7 pounds of oil per ton of ore (Tr., Vol. V., p. 2416, Qs. 16 and 17). Before the change, they used a mixture of creosote (Barrett No. 4) and petroleum (Jones oil), and since the change they have been using the same mixture (Tr., Vol. V., p. 2422, Qs. 42-44). The tailings loss of copper averaged, before the change, 0.48%; and, after the change, 0.32%. The average recovery before the change was 95.528%; and after the change, 96.936% (Tr., Vol. V., p. 2424, Q. 50). After the change the average amount of oil used was 22.18 pounds per ton of ore (Tr., Vol. V., p. 2421, Q. 37).

At the mill of the Ray Consolidated Copper Company the change from below 1% to above 1% of oil on the ore was made the middle of January, 1917. A tabulation of the results before and after the change is contained in Defendant's Exhibit 44 (Tr., Vol. IX., p. 5033). Before the change they used a mixture of creosote (Barrett No. 4) and petroleum (fuel oil), and since the change they have been using the same mixture (Tr., Vol. VI., p. 3244, Q. 37). Before the change of quantity of oil varied from 3.23 pounds to 5.28 pounds per ton of ore. Since the change it has varied from 18.77 pounds to 21.19 pounds per ton of ore (Tr., Vol. VI., p. 3243, Q. 31). The average extraction before the change varied from 91.80% to 96.52% in different years; and since the change it has been between 94.48% and 96.19%. The average copper in the tailings before the change varied from 0.397% to 0.617% in different years; and since the change it has been between 0.368% and 0.452%. At this mill also experiments were made to determine the results of keeping the mixture of oil constant, and varying only the quantity used, which experiments showed that with the mixture now employed inferior results were obtained when a diminished quantity of oil on the ore is used (Tr., Vol. VI., p. 3253, Q. 73, *et seq.*).

opinion that it would not be possible to practice the process with as large an amount of oil if that clayey gangue slime were absent?

"A. You could practice the process if you followed out the process of the Magna mill.

"x-Q. 110. Well, suppose we simply eliminate the criticism you make of the Magna mill and carry it out just the way they did at the Butte & Superior mill. Do you think that it would be impossible without the presence of this clay gangue slime you refer to?

"A. I should think it would be quite possible to carry out the process, yes.

"x-Q. 111. With the same amount of oil?

"A. Yes, with the same amount of oil.

"x-Q. 112. And the same procedure?

"A. Yes, the same procedure.

"x-Q. 113. And in the absence of the clay gangue?

"A. In the absence of the clay gangue, yes.

"x-Q. 114. And it still would be the agitation froth process?

"A. Absolutely."

Furthermore, the suggestion or contention that there is something in defendant's ore which "soaks up oil like a sponge" is conclusively contradicted by the statement made by Mr. Williams in his opening argument, where he said (printed report Plaintiff's Oral Arguments, pp. 27, 28):

" * * * we find that at the Timber Butte mill they have an ore which is *very nearly the same as the defendant's ore*, which is being treated with .7 of a pound of pine oil. * * * It comes pretty near to being the smallest amount that has been used."

If an ore which is "very nearly the same as defendant's ore" can be treated with "pretty near the smallest amount that has been used," it is evident that it does not have in it a constituent which "soaks up oil like a sponge."

This is confirmed by Defendant's Exhibit 158 (Tr., Vol. IX., p. 5184), which contains a report of defendant's flotation operations. This exhibit shows that during the year 1915 the average pounds per ton of oil used by defendant was 1.49 pounds, being 0.07% on the ore, and that the recovery was 90.36%, while the tailings carried 1.73% of values. These results could not

have been obtained if there had been in the ore something which "soaked the oil up like a sponge." Again, this exhibit gives the percentage of oil in the concentrates and in the tailings. If there was something in the ore which "soaks the oil up like a sponge" we would find most of the oil in the tailings, and comparatively little oil in the concentrates; whereas an examination of the exhibit will show that, when using more than 20 pounds of oil per ton of ore, the oil in the concentrates ran from 1.86 to 2.45%, while the oil in the tailings ran only from 0.55 to 0.71%. In the joint run at defendant's plant on April 29, 1917 (see Defendant's Exhibit 227, Tr., Vol. IX., p. 5294), the oil in the concentrates was 3.13%, and the oil in the tailings was only 0.35%. Nor is this a peculiarity of the results obtained when using above 1% of oil, for when only a small fraction of 1% of oil is used, the concentrates also carry most of the oil. This is shown in Prof. Chandler's table in the Hyde case (Tr., Vol. II., p. 161). That table shows that using a very small fraction of 1% of oil, the middlings and concentrates carried 87.2% of the total oil used, and the tailings carried only 12.7% of the total oil used; and this notwithstanding the fact that the quantity of the tailing was considerably more than the quantity of the middlings and concentrates.

WHY DEFENDANT AND OTHERS USE ONLY A LITTLE ABOVE 1% OF OIL AND DO NOT USE LARGER QUANTITIES.

Counsel for plaintiffs in the court below commented on the fact that in each of the above-named mills and in defendant's mill amounts of oil only slightly above 1% were used. They said these people were very careful not to use much above 1% of oil. The inference sought to be drawn from this is that larger amounts of oil could not be used and metallurgical results obtained. No such inference is admissible. Experiments on mill scale with much larger quantities of oil are described in the record, which experiments show that, except for the matter of cost, much larger quantities might be used (Defendant's Exhibit 31, Tr., Vol. IX., p. 4994).

The witnesses explain why they abstain from using much more than 1% of oil. Thus Engleman, of the Ray

Consolidated Copper Company, said, "it has been to date practically impossible to get enough oil to continue operations daily with the use of more than 20 pounds of oil per ton on seven thousand tons of feed" (Tr., Vol. VI., p. 3257, Q. 80). Wicks, of the Chino Copper Company, says that they had "a great deal of difficulty in some instances in getting the necessary tank cars and in getting the oil delivered" (Tr., Vol. V., p. 2454, Q. 189), and he explains from the records that on certain days when the quantity of oil used was cut down because they could not get sufficient oil to run at full capacity, using more than 1% (Tr., Vol. V., p. 2495, x-Q. 405, and p. 2498, x-Q. 427). T. A. Janney, of the Utah Copper Company, explains that their slimes plant is not in operation, because they cannot get enough oil to run it (Tr., Vol. V., p. 2578, Q. 170). He also states that to run the flotation plant of the Arthur and Magna mills to their full capacity, using no more than 20 pounds per ton of ore, would require 87,500 gallons of oil per day, and that they should carry at least 60 days' supply on hand to be safe (Tr., Vol. V., p. 2578, Qs. 175, 176). Dosenbach, one of defendant's engineers, says the defendant has had great difficulty in obtaining the amount of oil required (Tr., Vol. VI., p. 3375, Q. 245 *et seq.*).

THE SUGGESTION THAT BY SOME TRICK OF OPERATION DEFENDANT DOES NOT USE IN THE PROCESS THE AMOUNT OF OIL WHICH IT APPEARS TO USE IS NOT WARRANTED BY THE RECORD AND WAS IGNORED BY THE COURT BELOW.

Chapman, a technical witness for plaintiffs, in referring to the daily run at the Magna plant of the Utah Copper Company, which he saw on Saturday, April 22, 1917, insinuated that the first box was used as a de-oiling vessel. He did not say this positively and unqualifiedly, but in a manner that was evidently intended to reflect on the honesty of the Magna operation and on its staff. He said (T. R., Vol. VIII., p. 4426):

"Now, the overflow from the first box on the side of the machine that we were examining was very intermittent; I judge that it overflowed perhaps ten minutes in every hour. This intermittent over-

flow interested me so much that I made several visits to the *other side of the machine*, and I noticed that of the five visits that I made it was overflowing on four occasions ; and *indeed it would be quite easy, and it would be a great temptation to remove that oily float continuously in ordinary operations.*"

He does not boldly say such was the case, but that "*it would be easy,*" and that "*it would be a great temptation.*" Such testimony is not the kind to which courts of equity pay any serious attention. Strange it is, this being an *inter partes* affair, where every courtesy was extended to these witnesses of the plaintiffs' staff, that he did not call these alleged overflows to the attention of the observers who were present and representing the Magna plant.

The witness Greininger, a former member of plaintiffs' technical staff, was present as an observer for plaintiffs at the Magna plant on April 22d during that day's run, and said of the first spitzkasten (Tr., Vol. VIII., p. 4334) that—

"The first spitzkasten produced concentrate intermittently ; * * * the float in the first spitzkasten was very oily, largely an oil emulsion," etc.

He had, however, to acknowledge that (Tr., Vol. VIII., p. 4335, Q. 56)—

"At the time the sample was taken it was not overflowing."

This acknowledgment was due to the fact, undoubtedly, that during the taking of the samples an observer representing the plant was on hand.

Mr. Frank G. Janney, the general superintendent of all of the Utah Copper Company's mills, was called in rebuttal and testified that he was present at the mills of the Magna plant on April 22d during the visit of the witnesses Chapman and Greininger. He said in regard to the operation of the first cell (Tr., Vol. VIII., p. 4818, Q. 16) :

"The first cell was operating as an emulsifier * * * for some time * * * since the middle of January. No concentrate was produced in that cell.

* * * It is not the intention in our operations to produce a concentrate on that cell, and although a concentrate is formed of mineral-bearing froth, *it is not discharged*. Occasionally the froth fills up to such an extent that it discharges of its own accord, but not with our intentional operations."

Of the froth produced in the first cell under consideration, he says (Tr., Vol. VIII., p. 4820, Q. 24):

"It is a very light aerated froth, and the fact that it lies dormant on the surface of the water, and any air that is released in the spitzkasten has to rise through that froth, the result is that we get a very light, large bubble aerated froth."

THE CIRCULATING LOAD AND ITS EFFECT.

In the first spitzkasten, or the "rougher cells," as they are called, there is constantly being introduced (1) new ore, (2) the circulating load composed of water, *oil* and ore, called the "middlings," and (3) *new oil*. If no new oil were introduced at this point still it is obvious that some oil would be present. To determine, therefore, the percentage of oil actually present in the rougher cells, we must take account of the oil introduced with the middlings. Hence, if we wish to have in the rougher cells 1% of oil on the total ore present, and the middlings contain just 1% of oil on the ore contained therein, we must add just 1% of oil on the new ore which is added to the rougher cells, in order to have in the cells 1% on all the ore which is present in them (*i. e.*, the ore introduced with the middlings plus the new ore). For the same reason, if we still wish to have in the rougher cells 1% of oil on the total ore present, and the middlings contain 1.5% of oil on the ore, we must add just 0.5% of oil on an amount of new ore added equal in amount to the ore introduced with the middlings. If we should add more than 0.5%, an analysis of the contents of the rougher cells would show that there was present more than 1% of oil on the total ore in the cells.

This is a matter of simple arithmetic, and is fully explained by Conrads (Tr., Vol. V., p. 2703, *et seq.*). Not one of plaintiffs' witnesses has attempted to deny this simple and self-evident

fact. Plaintiffs' brief below, however, seemed to say that their witnesses have denied it; but in fact they have not. They simply have said that in their practice of the process heretofore they have never taken the oil in the middlings into account. They do not deny, however, that they should be taken into account if one desires to know the exact percentage of oil on the ore employed in the process.* The fact is, when operating with a circulating load, plaintiffs' witnesses have actually been using in the process a little more oil than their records indicate; but since they were not concerned, as defendant now is, in keeping track of the exact percentage of oil used, and since the amount used all-told was microscopic, it was perfectly natural that they should not trouble themselves about it. Defendant now must trouble itself about exact percentages, because (1) the question of infringement turns on it, and (2) the amount of oil used now is so large that economy compels defendant not to use more than it has to.

Plaintiffs' counsel in their brief below seemed to allege that since many cells are working simultaneously in defendant's mill, some of them in parallel and others in series, all the cells, after the first or rougher cells, must be operating on a smaller percentage of oil on the ore than is contained in the rougher cells. If this is what counsel mean to allege, the allegation is not at all in accordance with the facts, as is clearly proved by the record. For simplicity we will confine our discussion to the record of the joint test on April 29. The record of that test (Defendant's Exhibit No. 227, Tr., Vol. IX., p. 5294), taken in connection with the testimony of the

* Thus Grieninger only says (Tr., Vol. VIII., p. 4342, Q. 97) that he never considered nor took account of the oil in the circulating load as part of the oil supply; and (Q. 99) that he never looked upon it from the light or considered it from the standpoint of an oil-saving operation. Thus Chapman only says (Tr., Vol. VIII., p. 4437, Q. 45) that he has never taken it into account. Thus Wiggins only says (Tr., Vol. VIII., p. 4297, Qs. 20, 22 and 23) that he has never taken it into account in determining the consumption of oil in the process. Thus Rossbery only says (Tr., Vol. VIII., p. 4383, Qs. 103, 104) that he never returned the middlings for the purpose of saving oil.

Not one of these witnesses said, or could possibly say, that in determining the actual percentage of oil on the ore present in the rougher cells, the oil in the circulating load should not be taken into account.

witnesses (Tr., Vol. VII., pp. 3910 *et seq.*) shows the following facts: 1.77% of oil on the ore was present in the rougher cells. The concentrates from the rougher cells went through a series of cleaner cells. This concentrate contained more than 1% of oil (to-wit, an average of 2.74%); and when it was discharged as a finished product from the third and last cleaner cells, it contained a still larger percentage of oil (to-wit, 3.13%). The tailings from No. 1 cleaners contained more than 1% of oil (to-wit, 2.18%); and these were put into the circulating load and went back to the rougher cells. The tailings from No. 2 cleaners contained more than 1% of oil (to-wit, 2.24%); and these tailings were sent to waste. The tailings from No. 3 cleaners contained more than 1% (to-wit, 2.74%), and these were carried back as a circulating load to No. 2 cleaners. This completes the record of the cleaner operations, and gives a complete history of the concentrates discharged from the rougher cells. It will be seen that at all times the oil on the ore was more than 2%, and not less than 1%. The tailings from the rougher cells went to the middlings cells. From these cells the concentrates discharged contained more than 1% of oil (to-wit, 1.68%); and these were put into the circulating load and carried back to the rougher cells. The tailings from these middlings cells contained less than 1% of oil, but they were then and there shunted out of the system and discharged as waste.

The fact is, the process of the patent and the "critical proportions" of the patent have to do only with the percentage of oil on the ore in the rougher cells. The patent describes a one-cell process. Defendant's rougher cells correspond with the single cell of the patent, in which the prescribed amount of oil is to be used. After the ore has been treated in that cell, the patent says that the tailings may be subjected to any desired supplemental treatment. Thus it says (p. 2, lines 25-39) that the tailings may be treated on a shaking table or the like, and it says (p. 2, lines 103-119) that they may be treated with compressed air. These treatments are, however, mere adjuncts to the main process, and have nothing to do with that process *per se*. They are not claimed in the patent in suit. Indeed, the supplemental cleaning of the

tailings with compressed air is disclaimed, for the patent says (p. 2, line 116) :

“ This idea is not claimed broadly in this case, but forms the subject-matter of an application filed by us on January 9, 1906, Serial No. 295,326.”

In precisely the same sense defendant's treatment of the tailings in the middlings cells and callow cells (when used) are mere adjuncts of the main process, and have nothing to do with that process *per se*. Indeed, the concentrates produced in the middlings cells and callow cells (when used) are not taken off as a finished product, but are *returned to the circulating load and carried back to the rougher cells, to be there again subjected to treatment with something more than 1% of oil on the ore.*

THE ALLEGED PRESENCE OF SOLID GREASE IN THE FEED AT THE TEST ON APRIL 29TH.

It was stated several times in plaintiffs' brief in the Court below that particles of solid grease were present in the feed during the test of April 29th, and that these were due to the fact that the temperature of the water was from 10° to 12° Centigrade. It is also stated that Sadtler's experiments with defendant's oil mixture, showing that solid particles of grease could not have been present in it, were conducted with water at 18° Centigrade, and therefore proved nothing. The facts are these : In the first place, it does not appear that anybody took the temperature of the water with a thermometer during the test. All that Chapman says is that the temperature (Tr., Vol. VIII., p. 4437, Q. 43) “ I *should judge* to have been on that day between ten and twelve degrees Centigrade.” Evidently this was mere guess-work. In the second place, Sadtler does not say that his experiments were conducted with *water* at 18° Centigrade. What he says concerning defendant's mixture of oil which he duplicated (Tr., Vol. VIII., page 4806, Q. 16) is “ I made that mixture entirely in the cold, simply by stirring the ingredients together entirely in the cold, and the *temperature of the mixture* as taken by a thermometer at the time was 18° Centigrade, which

is relatively low, and *I believe* was under the temperature existing in the flotation mixture at the time of the visit on Sunday." In other words, he says the temperature of the *mixture of oils* when made was 18° Centigrade, and he *believed* that the temperature of the load during the test was above 18° Centigrade, and not between 10° and 12° Centigrade, as Chapman guessed. Both Chapman and Sadtler were guessing, and the guess of one is as good as the guess of the other. However, Sadtler gave 18° Centigrade as the temperature of the *mixture of oils* when made, and not the temperature of the *water* into which later he put the mixture. As to the temperature of the water into which he put the mixture, he said (Tr., Vol. VIII., p. 4806, Q. 16), "Then a small amount of that liquid was put into a bottle containing *cold* water and was shaken up energetically." He was not cross-examined as to the temperature of the water, and there is nothing in the record to show that he measured it with a thermometer.

Any argument based on the precise temperature of the feed at the joint test (which nobody thought worth while to determine with a thermometer) is evidently a mere catching at straws, because nobody will contend that the process in its essentials would be changed by such minute difference of temperature.

THE CONTAMINATED OIL OF THE 25% KEROSENE EXPERIMENT.

Plaintiffs' counsel in their brief below insinuated that defendant's experiments before the District Court with 25% kerosene were dishonest. They characterized them as "spurious experiments," and they spoke of the "exposure" of the deceit. As we have avoided discussing the Kirby patents (with which these experiments had to do) because these patents were before the Supreme Court in the Hyde case, we should logically pay no attention to these insinuations here; but as they constitute an attack upon the good-faith and fair-dealing of our witnesses, we cannot in justice to our client pass them by in complete silence.

The fact is, the kerosene used in these experiments did contain a trace—a mere trace—of an oil soluble in water, which may have been, we admit, pine oil. The first important question is: Was it there by design or was it there by acci-

ent? The next important question is: Was it present in sufficient quantity to account for the successful results of these experiments?

The answer to the first question will justify the insinuations of plaintiffs' counsel, or will dispose of them once and for all.

There is no question whatever but that the soluble oil present in the kerosene was there by accident and not by design, and that its presence was not suspected by defendant's witnesses when they performed their experiments in Court. Higgins discovered the presence of this "small amount" of contaminant, but it was so small in amount that he admitted they were "not able to isolate it" (Tr., Vol. VIII., p. 4619). Later Sadtler analyzed the kerosene carefully and found it to contain *twelve one-thousandths of one per cent.* (0.012%) of something soluble in water (Tr., Vol. VIII., p. 4802, Q. 11). Previously Dosenbach had been cross-examined about this kerosene, and had stated that nothing had been added to it after it was purchased (Tr., Vol. VII., p. 3891) and that, so far as he knew, it was not "contaminated in any way with other oils" (x-Q. 155); but that (x-Q. 149)

"Sometimes we have no tanks available and we have to use a tank that has contained other oils, but then that is very seldom. It is quite a hard problem to take care of all these different oils that come in, and it is necessary sometimes to put the kerosene, as well as other oils, into tanks that have contained different oils."

That in practice defendant cannot provide brand new tanks for each new kind of oil received, and that it must and does put oil when received into whatever empty tanks are available, without reference to what kind of oil the tank has held before, is too obvious to require testimony to prove it. What evidently happened was that the kerosene in question had been put in a tank which had previously contained another oil (possibly pine oil), which explains the presence of such an oil in a quantity which amounted to a mere trace. There is no reason whatever to doubt Dosenbach's statement that he believed the kerosene employed in the experiments was free from even a trace of other oils. This simple explanation completely disposes of the insinuations of bad faith aimed at our witnesses.

The only remaining question is whether this contaminating oil—assuming it to be pine oil—existed in the kerosene in sufficient quantity to account for the successful results of the experiments. As we have said, Sadtler found in the kerosene twelve one-thousandths of one per cent. (0.012%) of water-soluble oil. In the experiments 25% of kerosene on the ore was used. Hence the amount of pine oil (if it was pine oil) on the ore present was one-quarter of twelve one-thousandths of one per cent. It was, therefore, *three one-thousandths of one per cent.* (0.003%) on the ore—a mere trace of a trace of pine oil! Will anybody contend that 0.003% of pine oil on the ore will produce any substantial effect? We think not. At least no one has as yet advanced such a contention. Then, with what reason do the plaintiffs ask the Court to throw out of the case these experiments, especially when Sadtler was prepared to repeat them with the same kerosene oil freed from contaminant, and was prevented doing so by the strenuous objection of our adversaries (See Tr., Vol. VIII., pp. 4791 to 4801)? Our witnesses did not know that the kerosene used by them in the experiment was contaminated by a trace of another oil. When that fact was developed by the testimony of plaintiffs' witnesses, it was a complete surprise to our side; and we should have been permitted to repeat the experiments with purified kerosene, if anybody really thought that the presence of this trace of a trace of soluble oil was responsible for the successful results produced. Verily our adversaries have been reduced to the necessity of catching at mere straws and objected to having the flotation capacity of this particular straw exposed.

It is perfectly true that some kerosene oils can be found which will not produce a froth, for, as Sadtler said (Tr., Vol. VIII., p. 4790, Q. 6) :

“ Some kerosenes that I have tried cannot be made to raise a froth with the flowing ore pulp. Other kerosenes do. In tests and experiments made several years ago, I tested Pennsylvania kerosene, California kerosene, Oklahoma kerosene, and Texas kerosene, and in three cases out of four I was able to produce excellent mineral froths with kerosenes. With some of them I did not obtain any results. So I am of the opinion that

many kerosenes, absolutely free from any foreign mixture—and I should say that one of these California oils that I mentioned, California kerosenes, I made myself in my laboratory direct from the California crude oil by distillation of the kerosene fraction, * * * so that I had a standard kerosene fraction made from California petroleum that I could vouch for as being the genuine kerosene fraction of that crude oil. That kerosene is a good frothing agent, gave me excellent mineral froths. These results were gotten in June, 1914.”

This testimony was not contradicted and does not conflict with the experience of plaintiffs' witnesses, who tried samples of kerosene which would not produce a froth.

Indeed, the fact that petroleum alone will answer the purposes of the process is completely established in this case. As pointed out (*supra*, p. 47), in the earliest written description of the process the patentees themselves stated that “petroleum residuum” (the heavier fractions after the kerosene has been distilled off) and “paraffine oil” (kerosene) are among the oils which may be used as a substitute for oleic acid.

II.

The effect of the evidence presented in this case which was not before the Supreme Court in the Hyde case.

The next question to be answered is : Is the evidence presented in this case—evidence not before the Supreme Court in the Hyde case—of such character as, in the opinion of this court, would have led the Supreme Court to reach a different conclusion if it had been presented in the Hyde case ?

Considerable testimony has been taken in this case concerning the philosophy of froth concentration, in an effort by learned scientists to explain the whys and wherefores of the process. While this testimony is interesting and instructive, it is not necessary for this Court to consider it, because whatever may be the laws and manifestations of laws involved (a subject on which the scientific experts are not in complete agreement), the construction of the patent has been finally

determined by the Supreme Court. It is the law of the land respecting the patent in suit.

The Supreme Court's decision declaring valid claims 1, 2, 3, 5, 6, 7 and 12 was, we think, based on two alleged facts which were urged in argument, and which were apparently established by the proofs in the Hyde case. These were :

(a) While it is possible in the laboratory with prior-art quantities of oil and agitation to obtain highly useful metallurgical results using more than 1% of oil, yet such results cannot be duplicated in mill operations.

(b) There is a "divide" which separates the territory of the prior art from the territory of the patented process, and that "divide" is determined by the quantity of oil used, to-wit, a small fraction of 1% on the ore.

Both of these alleged facts, claimed by the plaintiffs to be established by the proofs in the Hyde case—facts on which we think the decision of the Supreme Court in that case was fundamentally based—are abundantly proved to be fictions by the evidence in this case.

(a)

Are we justified in saying that in the Hyde case it was urged in argument, and claimed to be established by the proofs, that while it is possible in the laboratory with prior-art quantities of oil and agitation to obtain highly useful metallurgical results, such results cannot be duplicated in mill operations ?

What Mr. Kenyon said in argument before the Supreme Court on this point was (printed report of arguments before the Supreme Court, p. 85) :

" MR. JUSTICE PITNEY : What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation ?

" MR. WILLIAMS : Absolutely no.

" MR. KENYON : It would not.

" MR. JUSTICE PITNEY : I understood him to say so yesterday, and I supposed there was something in the record to justify it.

“MR. KENYON: Nothing. That will be a part of my argument.

* * * * *

“Now as to the allegation that agitation will achieve the end with any amount of oil, it simply is not so.

* * * * *

“If a larger quantity of oil be added to the pulp, for example, two or three per cent., the Cattermole effect appears. With the same identical agitation, the oiled metal particles agglutinate and sink. The values are taken away at the bottom. This larger quantity of oil on the metal particle destroys the attraction of those particles for air cells, as evidenced by the fact that air is beaten into the pulp in the Cattermole agitation just the same as in the identical agitation in the process in suit, but it does nothing and escapes and, in spite of it, the values go to the bottom.

“MR. JUSTICE HOLMES: That is the formation of globules?

“MR. KENYON: The formation of globules. It utilizes the stickiness of oil.

“If still more oil than Cattermole proportions be added to the pulp, too much to act as an agglutinant, the same agitation will beat it up into a pasty magma or oil emulsion, no matter what the quantity of oil, entrapping air cells and metal particles, but having little affinity for either and destroying their affinity for each other.

* * * * *

“These oil magmas or froths with any amount of oil can be *readily produced in the laboratory*. But they are mere laboratory freaks, *absolutely useless in the mill*. In the mill granules would tend to form and go to the bottom. The froth would be fragile and drop in great chunks. It would not hold onto the metal. It would be unreliable and uncontrollable.

“As to the proposed demonstration to-morrow, it was our purpose simply to illustrate our process and let you see this intermediate product of our process, the froth, and the Cattermole metal-sinking process, but the respondent is concerned to prove by what he will show to-morrow alleged identity of froths by visual observation, therefore I must forewarn you.

“If the respondent tomorrow repeats the tests set out in his record, he will be doing what is nowhere shown in any part of the prior art, as our brief points out in detail.

“MR. JUSTICE PITNEY: He will be doing what?

“MR. KENYON: He will not be carrying out the processes of the prior art.

“MR. JUSTICE PITNEY: What will he be doing?

“MR. KENYON: He will be performing tests with large quantities of oil, just laboratory tests that he arbitrarily chooses to perform. He will give them the names of old processes; he will call them Everson, Kirby, Froment, but they will not be either of those three.

“1. They will be carried on in modern machinery not known at the time.

“MR. JUSTICE MCKENNA: Pardon me one question. Will they be using more than *one-half of one per cent.* of oil?

“MR. KENYON: Yes, sir; anywhere up to 25 per cent.

“MR. JUSTICE MCKENNA: Yet they result in the production of a froth?

“MR. KENYON: You will have an oily mass or magma at the top, but it will *not do anything towards concentration of ores.* I am coming right to that point now.

* * * * *
 “MR. JUSTICE MCKENNA: *Your contention then is that the laboratory test is no standard.*

“MR. KENYON: *Yes, sir; absolutely no standard whatever.*

“MR. JUSTICE MCKENNA: *Do you admit that the laboratory tests show a similarity?*

“MR. KENYON: *Yes. I cannot myself tell one float from another by visual observation. But the mill man will tell you the instant he tries to carry out the process in the mill.*

“Indeed even minute departures in the mill from the standard oil quantity needed for the particular ore are harmful, and I want your Honors to mark page 196 of our brief on that point.

“Mr. Chapman was asked:

“‘What has been your experience when, in using the agitation-froth process on a commercial scale, with a normal and proper consumption of one and a half pounds of oil per ton of ore, this procedure has been varied by increasing the oil feed to 2½ pounds per ton of ore?’

“NOTE: This was only a small increase. He says the tailings, on examination, immediately showed increased losses of sulfide mineral. The result was harmful.

* * * * *
 “MR. JUSTICE MCKENNA: *Are there any experiments on the other side showing more than laboratory tests?*

“ MR. KENYON : *No, sir. They stop with laboratory tests. To-morrow you will see, but you will not know. The layman cannot tell the useful froth of the process in suit from a useless oil emulsion ; whether it is a step in a real process of ore concentration or only a sham ; whether it can be reproduced in the mill or not, or would treat or successfully concentrate ore. It is a situation for caution, especially as the court below was misled by just such demonstrations* ” (pp. 85-90).

Mr. Kenyon supported his statement by reference to the record as follows (printed report of arguments before the Supreme Court, p. 88) :

“ Finally, such oil froth processes are *absolutely not usable in the mill at all*. To demonstrate that I want to turn to the evidence of Dr. Byrnes, for the defendant. I presume this will be one of the tests that will be shown you to-morrow. I do not know what it will be called to-morrow. Record, page 108, Second Experiment Froment. 3.6 per cent. of cotton seed oil agitated in our slide machine, about two pounds of the ore treated. Result : his tailings showed only one per cent. of zinc—wonderfully clean tailings ; his recovery, as figured by Dr. Liebmann (page 299) was about 100 per cent. of the values—a remarkable recovery.

“ We followed identically that same process first in a seven-ton a day plant, a semi-commercial plant, and then in a fifty-ton a day plant, a full commercial plant—to see what would happen. We did just the things there that Dr. Byrnes did in the laboratory. Mr. Higgins testifies as to the first at page 387 of the record. Result : his tailings showed 12 per cent. zinc, and his recovery was only 50 per cent. of the values. Half of the values were gone. He says the float fell in masses ; that the tailings had some granules (the Cattermole effect had been to some extent produced) ; that the recovery was not satisfactory.

“ Chapman testifies as to the test in the fifty-ton plant (pp. 388-391). 1,680 pounds of ore were run through in each of the four tests. In the first test the tailings showed 17 per cent. of zinc. Seven-eighths of the original zinc in the ore was in the tailings. He then added more acid, to favor the process. 14 per cent. of the tailings were zinc. Seven-tenths of the values went away in the tailings. He then diminished the duration of the agitation, to favor it, and 17.5 per cent. of the tailings were zinc. Four-fifths

of the values run away with the tailings. He says these processes were absolute failures as to results (page 390 of the record). Then he cut the oil in two, using 1.8 per cent. of cotton-seed oil. His tailings were 13 per cent. oil. The recovery was 69 per cent. But he says of it that the 'result' was of 'no commercial value at all' (Record, page 391)—that there was '*really no concentration at all*' (Record, page 392)—that the *concentrate was practically of no more value in proportion of metal afterwards than before.*"

Mr. Williams, in his argument (pp. 33), said :

"So we had Mr. Higgins carry out the same operation, practically the same, with 3.6 per cent. of oil in a little testing plant which was available at the mines of Senator Clarke in Butte, Montana. It was only a little plant. It was not a full size operation. In that operation he lost 50 per cent. of his metal. He said that it fell down in bunches when it spread out on the surface of the spitzkasten, and although at a little distance it looked like our floating froth, on close inspection it was found to be an oily floating mass. It fell down in bunches, and it only saved 50 per cent. of the zinc and threw away the rest of it. But we were not satisfied with that. We took the smallest full-size plant, the 50-ton plant, through which 50 tons of ore are carried by 200 tons of water in twenty-four hours, and we carried out an operation in that, and there the loss was 82 per cent. It was hopeless. *So that we demonstrated the negative of the proposition that the defendant had failed to demonstrate. We demonstrated that these products of the legerdemain of the laboratory, not prior art at all, were worthless in the concentration of ores, wholly regardless of the question of the cost of oil or anything else.*"

On behalf of the defendant in the Hyde case there was no testimony whatever contradicting these proofs. Indeed, it was not possible at the time the proofs were taken in that case to produce such testimony, because it was not until the spring of 1913 that the defendant became convinced that flotation would be a success in mill operations, and adopted it (Tr. VI., p. 3528, x-Qs. 53, 54), while the testimony in the Hyde case was closed before the beginning of the year 1913.

So, in the Hyde case, the proofs were all to the effect that a quantity of oil above a small fraction of 1%, while apparently capable of yielding useful metallurgical results in the laboratory, was incapable of yielding similar results in mill operations.

In this case the converse of that proposition is abundantly established.

For example, Defendant's Exhibit 31 (Tr., Vol. IX., p. 994) gives the results of a series of mill operations at the Arthur plant of the Utah Copper Company in which different quantities of the same oils were used. In the first series (Nos. 1 to 13) the same oil mixture was used varying in amount from 6.87 pounds per ton to 96.46 pounds per ton (*i. e.*, from about 0.33% to 5%). An extraction of 96.39% was obtained with the use of 5% of oil. While a higher extraction (98.41%) was obtained with the use of less oil (25.50 pounds per ton) yet the difference is clearly one of degree and not of kind.

The continuous daily practice since December, 1916, not only of the defendant, but of the Utah Copper Company at its Magna and Arthur plants, the Chino Copper Company, and the Ray Consolidated Company in the use of oil in quantities greater than 1% on the ore, conclusively establishes the fact that the use of oil in quantities larger than 1% produces useful metallurgical results not only in the laboratory but also in the mill.

(b)

Are we justified in saying that it was alleged in argument, and apparently established in the proofs in the Hyde case, that there is a "divide" which separates the territory of the prior art from the territory of the frothing process, and that such "divide" is determined by the quantity of oil used, to-wit, a small fraction of 1%?

The testimony in the Hyde case on this point has heretofore been set forth in this brief (*supra*, pp. 11-16). It only remains, therefore, to state what Mr. Kenyon said on this point in his argument before the Supreme Court (printed report of argument before the Supreme Court, p. 91):

"Now, the very best possible argument of invention is found right on page 448 and page 451 of the record

[*i. e.*, pp. 1108 to 1112 of the *Transcript in this case*]—the story of the birth of the invention. Because as the quantity of oil was diminished (see column three of ‘*Details of Experiments*,’ p. 448, ‘*i. e.*, p. 1109 of the *Transcript in this case*’)—as the quantity of oil was diminished the Cattermole granulation became worse and worse. That was degree. *But there came a time when you got over the divide, and something else happened. Just the contrary happened.* As you then from that point went on diminishing the oil that new result increased. That was not degree. *You had gone over the divide. You were in a new country.*

“It is apparent now that the inventors in their *minute one-tenth of one per cent.* oil frothing reagent were really invoking a characteristic and a power of oil in an ore concentration process that develops *only in that relatively microscopic quantity*, and which is defeated and disappears when that *minute quantity is even slightly exceeded*, a characteristic and a power of oil which had not existed in the prior oil concentration processes of the art, which had never been utilized by anybody for ore concentration, and the very existence of which had not been known or suspected. They were invoking the power of oil when present in *microscopic amount* to exercise the powers of the air to search out and find in the swirling vortex of the pulp, and hold on to through the seven or eight minutes of agitation, and safely bring to the top at the end, the valuable mineral particles and hold on to them there until they could be floated away. They harnessed the giant of the air to their task, and the oil was only curb and bit. It was a wholly new role for oil to play, a wholly new function for oil to perform, a wholly new combination of oil and air. That takes this process right out of the oil concentration art. It is not a process of oil concentration. It is a process of air concentration, as both the House of Lords and the Privy Council have held.”

In this connection we also refer this court to the colloquy between Mr. Justice McREYNOLDS and Mr. Kenyon, quoted *supra* (p. 17).

In the present case the court hears nothing about the “divide,” or about the “critical” and “microscopic” quantities of oil which alone will do useful work; for here it is admitted that prior-art quantities of oil will do useful work, and it is sought to make the patent cover such quantities—any quantity, in fact, which will do useful work.

If plaintiffs' present contentions had been presented to the Supreme Court, who will say that court would have found the patent valid? It was found valid on the understanding that only critical and microscopic quantities would do useful work in the mill, and it was sustained only as limited to such critical and microscopic quantities.

III.

Plaintiffs have no right to maintain this suit because they have "unreasonably neglected or delayed to enter a disclaimer".

Our contentions with respect to the so-called disclaimer are :

(a) If the so-called disclaimer had its intended effect of broadening claims 9, 10 and 11, it is not a disclaimer in fact, and is a nullity.

(b) If the so-called disclaimer has not changed the scope of claims 9, 10 and 11, it is not a disclaimer in fact, and is a nullity.

(c) In either of the above cases, since plaintiffs' right to maintain this suit is derived solely from the remedial and enabling disclaimer sections of the statutes, which require the filing of a disclaimer *without unreasonable delay*, the plaintiffs now have no right to maintain this suit.

At common law a patent which was bad in part was bad in whole ; a patent containing one invalid claim was wholly void (*Silsby vs. Foote*, 20 How., 378, 380 ; *Walker on Patents*, Sec. 203). Indeed, such is the rule in England to-day (*Frost Patent Law and Practice*, Vol. I., p. 251).

Speaking of Sections 4917 and 4922, the Supreme Court, in *Hailes vs. Albany Stove Company*, 123 U. S., 582, speaking by Mr. Justice BRADLEY, said (p. 589) :

" They are parts of one law, having one general purpose, and that purpose is to obviate the inconvenience and hardship of the common law, which made a patent *wholly void* if any part of the invention was wrongfully claimed by the patentee, and which made such a defect in a patent an *effectual bar* to a suit brought upon it."

At common law a patentee had the right, if his patent was defective, and the defect arose through inadvertence, accident or mistake, to *surrender* the grant and obtain an amended grant for the unexpired portion of its term. This common-law right was affirmed as early as 1832 by the Supreme Court in *Grant vs. Raymond*, 6 Pet., 218.

Shortly thereafter and in the same year (1832), Congress enacted a statute to regulate the grant of reissued patents, which, without material change, appears now as Section 4916, R. S. (*Walker on Patents*, Sec. 211).

While the reissue statute permitted a patentee to *surrender* an invalid patent and obtain a reissue (*by which act he forfeited all rights to past damages and profits*), it did not change the common-law rule that a patent bad in part was bad in whole, and that an invalid patent could be amended only by surrender and reissue. In order to mitigate the hardship of that rule, the disclaimer statutes were enacted in 1837, which, without material change, appear to-day as Sections 4917 and 4922, R. S., which read as follows :

“ SEC. 4917. Whenever, through inadvertence, accident or mistake, and without any fraudulent or deceptive intention, a patentee has claimed *more* than that of which he was the original or first inventor or discoverer, his patent shall be valid for all that part which is truly and justly his own, provided the same is a material or substantial part of the thing patented ; and any such patentee, his heirs or assigns, whether of the whole or any sectional interest therein, may, on payment of the fee required by law, make disclaimer of such parts of the thing patented as he shall *not choose to claim or to hold by virtue of the patent* or assignment, stating therein the extent of his interest in such patent. Such disclaimer shall be in writing, attested by one or more witnesses, and recorded in the Patent Office ; and it shall thereafter be considered as part of the original specification to the extent of the interest possessed by the complainant and by those claiming under him after the record thereof. But no such disclaimer shall affect any action pending at the time of its being filed, except so far as may relate to the question of unreasonable neglect or delay in filing it.”

“ SEC. 4922. Whenever, through inadvertence, accident or mistake, and without any willful default, or intent to defraud or mislead the public, a patentee has,

in his specification, claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was *not* the original and first inventor or discoverer, every such patentee, his executors, administrators and assigns, whether of the whole or any sectional interest in the patent, may maintain a suit at law or in equity, for the infringement of any part thereof, which was *bona fide* his own, if it is a material and substantial part of the thing patented, and definitely distinguishable from the parts claimed without right, notwithstanding the specifications may embrace *more* than that of which the patentee was the first inventor or discoverer. But in every such case in which a judgment or decree shall be rendered for the plaintiff, no costs shall be recovered unless the proper disclaimer has been entered at the Patent Office before the commencement of the suit. *But no patentee shall be entitled to the benefits of this section if he has unreasonably neglected or delayed to enter a disclaimer.*"

In substance, Section 4917 provides that in case of an overclaim, a patentee, *without surrendering his patent* (and thereby extinguishing all claims for past infringements), may cure the defect by filing a disclaimer in the Patent Office ; and Section 4922 provides that a patentee may maintain a suit on his patent while it contains an overclaim, providing, however, "*no patentee shall be entitled to the benefit of this section if he has unreasonably neglected or delayed to enter a disclaimer.*"

It follows, therefore, that if a patent contains an overclaim, and the patentee unreasonably neglects or delays to cure it by disclaimer, he loses all right of action under the patent.

The District Court of Delaware in the Miami case as early as September, 1916, decided that claim 9 (claims 10 and 11 not being in issue in that case) was broader than the patentee's actual invention. According to some authorities, it thereupon became incumbent on the plaintiffs to promptly file a disclaimer if they would preserve their right of action on the valid claims. The fallacy of this rule, however, was pointed out by the Circuit Court of Appeals for the Second Circuit in *Page vs. Dow-Jones*, 168 Fed., 703. As the Court there said, clearly a patentee has the right to wait until the Court of last resort has determined the existence of the overclaim, before he is called upon to file a disclaimer. In other

words, it was not unreasonable for the plaintiffs to delay filing a disclaimer until the Court of last resort had finally determined the fact of the existence of an overclaim.*

In December, 1916, the Supreme Court handed down its decision in the Hyde case, and by that decision it was authoritatively and finally determined that the patent in suit contained an overclaim, in that claims 9, 10 and 11 were broader than the patentees' actual invention. After that decision was handed down, it was incumbent on the plaintiffs to file without unreasonable delay a disclaimer which would cut out this overclaim if they wished to maintain their right to sue on the valid claims of the patent (*O'Reilly vs. Morse*, 15 How., 62, 120; *Seymour vs. McCormick*, 19 How., 96; *Gage vs. Herring*, 107 U. S., 646).

While the plaintiffs did, thereafter, file a paper in the Patent Office which they called a "disclaimer", we contend that that paper was not intended to cut out the condemned overclaim, and did not, in fact, cut out the condemned overclaim. We contend that, therefore, no disclaimer in contemplation of Sections 4917 and 4922 has been filed and, for this reason, that plaintiffs have no right to maintain this suit, because the patent still contains the condemned overclaim.

The so-called disclaimer filed in the Patent Office by the plaintiffs, in its material part, reads as follows (Tr., Vol. I., p. cxxxiii) :

"Your petitioner * * * does hereby disclaim from claims 9, 10, and 11 of said Letters Patent No. 835,120, any process of concentrating powdered ores excepting where the *results obtained are the results obtained* by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

* The question as to when the period of "unreasonable delay" begins to run was raised as early as 1857 in the case of *Silby vs. Foote*, 20 Howard, 378. Justices GRIER and DANIEL in a dissenting opinion expressed the view that the period begins to run when a claim is declared invalid by a Circuit Court (p. 388); but by the prevailing opinion it was held that the period does not begin to run until the Supreme Court has passed upon the validity of the claim (p. 386). *That the period begins to run when the Supreme Court has declared a claim invalid has never been questioned, and, indeed, is not open to question.*

(a) What was the intended effect of the so-called disclaimer ?

To ascertain its intended effect we must go to the statements made by plaintiffs' counsel.

Plaintiffs' counsel stated in their oral arguments and in their brief in the Court below, that the purpose of the disclaimer was, in effect, to erase from claims 9, 10 and 11 all limitations as to the quantity of oil used, provided only the desired result was obtained.

In other words, whereas the patentees should have filed a disclaimer erasing the invalid claims, or limiting them, as the valid claims were limited, to the use of a fraction of 1% of oil on the ore (in which case the invalid claims as limited by the disclaimer would not differ materially from the valid claims), what they actually attempted to do was to broaden claims 9, 10 and 11 to cover the use of any quantity of oil, however large, which would accomplish the desired result.

Thus, in the oral argument before the Court below, Mr. Kenyon said, in answer to a question by the Court (p. 61*) :

“ THE COURT : The patent here in suit has been rather narrowly construed ?

“ MR. KENYON : On the contrary I think the Supreme Court has construed this patent *broadly* as for the process if and whenever the *results obtained are those that are obtained* when you effectively use this small quantity of oil.”

Further he said (p. 64) :

“ In one sense this is a construction of the patent, a holding that the patent cannot be extended beyond that line. That is to say, the patent cannot be extended, under the Supreme Court holding, to the case of a process that *does not obtain the results there specified* ; but it is, by the same token, a holding that the patent should be extended up to that point. It is equivalent to laying down a rule for determining any question of infringement of this patent (assuming oil and aeration, agitation and pulp), that the *results obtained* shall be the guiding test of infringement.”

*The pages referred to here and following are those of the printed book entitled “ Plaintiffs' Oral Arguments.”

Further, he said (p. 82) :

“ First, as to the Supreme Court decision, for that is the most important thing in this whole litigation, and the meaning of that decision, for it is compelling upon this Court, whatever it may mean. Your Honor asked me if it was not a narrowing decision in a sense. In a sense it is a narrowing decision, and that feature of it, I think, strikes one on the first reading—on the first two or three readings—perhaps more prominently than anything else. But, studying and analyzing it, I believe it is essentially a *broadening* decision, and an *unusual and extraordinarily broadening* decision, and from that point of view I want to ask your Honor to study it a little with me.”

Further, he said (p. 90) :

“ Now, why did the Court uphold claims 1, 2, 3, 5, 6, 7 and 12 as valid, and hold claims 9, 10 and 11 invalid? Why, in my judgment, just because the Court felt that claims 9, 10 and 11 were broad enough in their language to cover this oil-lift of the prior art, and the oil-float or magma that it had distinguished as old; just because the Court felt that those three claims, 9, 10 and 11, were not, as the others were, limited to the results obtained by the air-lift and in the air-froth. By our disclaimer we have disclaimed every procedure that might by any possibility have been included within those claims except the procedure recited in them when the result obtained by it is the new result defined by the Supreme Court, thereby aligning those claims with what the Court has said our patent must be confined to, with what the Court thereby says our patent may and should cover. Not results *per se*; no, that is not what the Supreme Court has said our patent is for; if it had so said, that would be the law of the land and of this patent and of this case. But it has not so said. Not results irrespective of process, but the process, the procedure, recited in those claims when and as limited to, and *recognized and determined by, those results.*”

Further he said (p. 91) :

“ Now, that, I maintain, is a broad and fundamental decision; a broad and an unusually *broadening* decision,

and it gives to this patent a scope as broad as the *oil-modified air-lift*, and the *metal-carrying air-froth* specified (when you have ore, water, oil and agitation), as contrasted with the *oil-lift* and the *metal-carrying oil-float* of the prior art."

Further he said (p. 92) :

" So I submit that the Supreme Court decision is a guide, and a guide clear and definite and *broadening*, and that this court must apply to this patent the full measure of the definition of the Supreme Court ; not, says the Supreme Court, to include an oil-lift and an oil-float, but to include every instance, it says in effect, of an air-lift and an air-froth *such as is obtained* when in the vital air-bubble metal-particle combination you have oil present in a fraction of one per cent. on the ore."

Further he said (p. 93) :

" The Supreme Court has limited the patent to an air-lift and an air-froth, and to the *sort of* an air-lift and air-froth that is produced when a fraction of one per cent. of active oil is added in the way and with the agitation specified. It has read 'air-froth' into every claim, instead of 'froth,' by cutting out oil-froth, and it has read into every claim the lifting by air as contrasted with the lifting by oil ; and the disclaimer so limits claims 9, 10 and 11, and it is as if, for example, claim 9 read : ' The process of concentrating powdered ores which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth, when the *results obtained are substantially those that are obtained by the same procedure* when the oil effectively used is a fraction of one per cent. on the ore.' THAT IS THE LEGAL EFFECT OF THAT DISCLAIMER."

Plaintiffs' counsel in their brief before the Court below explained why they did not disclaim the invalid claims. They said (p. 55) :

" The Supreme Court did not, as courts often do, direct the filing of a disclaimer. The burden was

cast upon parties and counsel of deciding all the momentous questions involved. Had the patentees wholly disclaimed claims 9, 10 and 11, an infringer might triumphantly assert that *all claim to any process employing one per cent. or more of oil had been abandoned by the affirmative act of the patentees, and that therefore the patentees were forever estopped from asserting that a process substantially the same as theirs and producing the same result by the same mode of operation, but using one per cent. or more of oil, was within their patent.*"

After quoting that part of Mr. Kenyon's oral argument above quoted, in which he paraphrases claim 9, as modified by the disclaimer, they said (p. 58) :

" So far as claim 9 is concerned, no distinction need be made between effective oil and inert oil. The identification by the *new result* associated with the words ' a small quantity of oil ' *obviates any oil-quantity measurement as to the amount of oil used.*"

What this means in plain English is, that any quantity of oil above 1% on the ore, no matter how large it may be, is now the " small quantity " of claims 9, 10 and 11, so long as it does the work—which is only another way of saying that the limitation to a " small quantity " of oil was intended to be, and if plaintiffs' counsel are right, has been completely erased from claims 9, 10 and 11 by the disclaimer.

So we see that these claims, which the Supreme Court said were too broad because they included the use of any " small quantity " of oil, have not by the disclaimer been limited to the use of a smaller quantity of oil, but have been broadened (if plaintiffs have accomplished their purpose) so that they are not now limited at all as to the *quantity of oil used* but only to the *results obtained*.

The trick of the disclaimer consists in artfully repeating certain words taken from the Supreme Court opinion in such a way as to give them an entirely different meaning. The Supreme Court said (242 U. S., 271) :

" The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as ' critical proportions '."

This language seems to be perfectly clear and entirely free from ambiguity. It says plainly that the patentees are not entitled to monopolize the results obtained by the use of oil in larger quantities—that the use of oil in larger quantities cannot be covered by this patent.

The disclaimer, however, instead of saying that claims 9, 10 and 11 are limited to the “*results obtained by the use of*” the so-called critical proportions of oil, say they are limited to a process in which the “*results obtained are the results obtained by the use of*” the so-called critical proportions of oil. By repeating the words “results obtained” in this way, their purpose was to expand the claims to cover any process using oil in which the results obtained were *like those* obtained by using the critical proportions of oil. The trick is clever, but it is transparent. The Supreme Court said the claims must be limited to the “results obtained by the use of” the critical proportions. The disclaimer says they are limited to “results obtained” *which are like those obtained* “by the use of” the critical proportions.

Assuming, for the sake of argument, that the Supreme Court decision was a “broadening” decision (which, of course it was not), yet the only way in which advantage could be taken of it is by means of a *surrender* and *reissue* of the patent—that is, by a proceeding under Section 4916. The disclaimer sections are strictly limited to cases in which (Sec. 4917) “the patentee has claimed *more* than that of which he was the original or first inventor or discoverer,” and (Sec. 4922) has “claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was *not* the original and first inventor or discoverer,” and the only act on the part of the patentee justified by these sections is that he may (Sec. 4917) “make disclaimer of such parts of the thing patented as he shall *not choose to claim or to hold by virtue of the patent.*” * A disclaimer

* Nothing is better settled than that there is no warrant in law for *broadening* a patent by disclaimer, and no warrant in law for converting by disclaimer a claim for one thing into a claim for a *different* thing.

In *Union Metallic Cartridge Co. vs. U. S. Cartridge Co.*, 112 U. S., 624, the Supreme Court, speaking by Mr. Justice BLATTFORD, said (642):

“A disclaimer can be made only when something has been claimed of which the patentee was not the original or first inventor,

which seeks to broaden a patent is, therefore, without warrant of law, and is a nullity.

(b) Having ascertained the intended effect of the so-called disclaimer, and having shown that if the intended effect was accomplished the so-called disclaimer is a nullity, we shall now proceed to ascertain what is the actual effect of the so-called disclaimer.

We contend that the so-called disclaimer did not disclaim anything, but leaves the claims in precisely the same condition they were before the paper was filed, and that it is, therefore, a nullity.

and when it is intended to limit a claim in respect to the thing so not originally or first invented. It is true that, in so disclaiming or limiting a claim, descriptive matter on which the disclaimed claim is based, may, as incidental, be erased, in aid of, or as ancillary to, the disclaimer. But the Statute expressly limits a disclaimer to a rejection of something before claimed as new, or as invented, when it was not new or invented, and which the patentee or his assignee no longer chooses to claim or hold."

In *Carnegie Steel Co. vs. Cambria Iron Co.*, 185 U. S., 403, the Supreme Court, in approving a disclaimer, speaking by Mr. Justice BROWN said (436):

"Had the purpose of the disclaimer been to reform or alter the description of the invention, or convert the claim from one thing into something else, it might have been objectionable, as patents can only be amended for mistakes of this kind by a reissue."

In *White vs. Gleason Mfg. Co.*, 17 Fed., 159, Judge WHEELER, condemning a disclaimer, said :

"The disclaimer could add nothing to the patent. It could take away from what was described as the invention and claimed as such, so as to be covered by the grant of the patent, but it had no office to make the patent cover anything, however clearly shown in the patent, not so described and claimed as a part of the invention.
* * * Such changes appertain to reissues and not to disclaimers."

See, also, *Hailes vs. Albany Stove Co.*, 123 U. S., 582, 587; *Albany Steam Trap Co. vs. Worthington*, 79 Fed., 966, 969; *Westinghouse Air Brake Co. vs. New York Air Brake Co.*, 139 Fed., 265; *Bracewell vs. Passaic Print Works*, 107 Fed., 467, 469.

It is, therefore, a perfectly well-settled principle of law that the only function of a disclaimer is to limit a patent. A disclaimer which attempts to broaden a patent, or which attempts to change a claim for one thing (as the use of a "small quantity" of oil in the production of a froth), into a claim for a different thing (as the production of a froth by the use of *any quantity* of oil), is a nullity.

To simplify our argument, we will limit it to a discussion of claims 1 and 9 as typical, respectively, of the claims sustained and of the claims condemned.

These claims read as follows :

Sustained by Supreme Court. *Condemned by Supreme Court.*

1. The herein-described process of concentrating ores which consist in mixing the powdered ore with water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (*amounting to a fraction of one per cent. on the ore*), *agitating the mixture until the oil-coated mineral matter forms into a froth*, and *separating the froth* from the remainder by flotation.

9. The process of concentrating powdered ores which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a *small quantity of oil*, *agitating the mixture to form a froth*, and *separating the froth*.

Before disclaimer, claim 9, as well as claim 1, was limited to the production of the "froth" described in the specifications. Thus claim 1 calls for "agitating the mixture until the oil-coated mineral matter forms into a *froth*, and separating the *froth* from the remainder by flotation," while claim 9 calls for "agitating the mixture to form a *froth*, and separating the *froth*." However, plaintiffs' counsel say (*supra*, p. 77) that the purpose of the disclaimer was to limit claim 9 to the production of such a "froth." But claim 9 was already limited to such "froth" in terms; so the disclaimer did not, in fact, change the meaning of the claim at all.

That claim 9 before disclaimer was limited to the production of the "froth" described in the specifications must necessarily be true, unless the word "froth" in claim 9 is given a different meaning from the same word in claim 1—a construction which no one will seriously contend for.

The above consideration exposes the fallacy of our adversaries' contention that the Supreme Court decision is a broadening decision. The Supreme Court condemned claim 9, which was limited in terms to the "froth" of the patent, because it was not limited to the designated *critical quantity of oil* to which the sustained claims were limited. It did not

condemn claim 9 because it was not limited to the production of the "froth" of the patent, because it was, in fact, limited to such froth in terms, precisely as were the sustained claims. In other words, claims 1 and 9 were alike in that they both were limited to the production of the "froth" of the patent, and were unlike in that claim 1 was limited in terms to the prescribed *critical quantity of oil*, while claim 9 was not so limited. Yet complainants' counsel gravely contend that the Supreme Court's decision means that the vice of claim 9 was not in the respect in which it *differed* from claim 1, but was in respect to that feature in which it was *identical* with claim 1. We submit that no amount of ingenuity can spell anything so illogical out of the language of the Supreme Court.

The statement was made in oral argument by plaintiffs' counsel below that the Supreme Court condemned claims 9, 10 and 11 because the term "a small quantity" of oil which they contain is *indefinite*. The Supreme Court did not condemn these claims on such technical grounds. It condemned them because the claims were *too broad*, as clearly appears from the language of the opinion, where it says (242 U. S., 271) :

"While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion, there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (*The Barbed Wire Patent*, 143 U. S., 275), yet the investigations preceding were so informing that this final step was not a long one, and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore,' and therefore the decree of this court will be that the patent is valid as to claims No. 1, 2, 3, 5, 6, 7, and 12, and that the defendant infringed these claims, but that it is invalid as to claims 9, 10, 11. Claims No. 4, 8 and 13 were not considered in the decrees of the two lower courts and are not in issue in this proceeding."

Claims 9, 10 and 11 were therefore condemned, not because they were *indefinite*, but because the use of a "small quantity" of oil WAS OLD.

So the Supreme Court has said, as plainly as words can say it, that it condemned claims 9, 10 and 11 because they were not limited, as the other claims were, to the "critical proportions" of oil. The plaintiffs, instead of correcting this over-claim by disclaimer, as they were bound to do if they desired to maintain their right of action under the patent, left the over-claim standing, and pretended to limit the condemned claims by inserting a feature which was always in them—not by implication, but in terms.

The result is, as we have said, the condemned claims are not changed one iota by the disclaimer. The so-called disclaimer is a disclaimer in form only, and not in substance. It is a nullity.

(c) We have shown that the plaintiffs' right to maintain this suit, if they have any such right, is derived from the provisions of Sec. 4922 R. S., and from no other source. We have shown that the "benefits" of that section extend only to those who have not "unreasonably neglected or delayed to enter a disclaimer". We have shown that the paper entered in the Patent Office and called a "disclaimer" is not a disclaimer in fact; that plaintiffs' counsel who filed the disclaimer admit that its purpose was not to limit claims 9, 10 and 11 to the use of a fraction of 1% of oil, but was, by a tricky repetition of words used by the Supreme Court, an attempt to make these claims cover any process in which the desired results are obtained. We have shown that if this purpose was not accomplished the so-called "disclaimer" has not changed the scope of the claims and is not a disclaimer in contemplation of law; and in any case is a nullity.

Such being the facts, no one will say that the plaintiffs have not "unreasonably neglected or delayed to enter a disclaimer." Not only have they failed honorably to conform with the conditions imposed by the statute as precedent to the enjoyment of the "benefits" of Sec. 4922; but they have done worse. They have attempted by shifty practices to expand their patent while pretending to limit it.

Deprived of the "benefits" of Sec. 4922, they have no right to maintain this suit.

CONCLUSION.

It is respectfully submitted that the decree below should be reversed and the case remanded with appropriate instructions.

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IN THE
United States Circuit Court of Appeals
For the Ninth Circuit

BUTTE & SUPERIOR MINING COMPANY,

Appellant,

vs.

MINERALS SEPARATION, LTD., et al,

Appellees.

No. 3081

BRIEF FOR APPELLEES.

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IN THE
United States Circuit Court of Appeals
For the Ninth Circuit

BUTTE & SUPERIOR MINING COMPANY,

Appellant,

VS.

MINERALS SEPARATION, LTD., et al.,

Appellees.

No. 3081

BRIEF FOR APPELLEES.

This is an appeal from a decree of the District Court for the District of Montana adjudging the validity and infringement of claims 1, 2, 3, 5, 6, 7, 9, 10, 11 and 12 (claims 9, 10 and 11 as limited by disclaimer) of letters patent No. 835,120 issued to Sulman, Picard and Ballot, November 6, 1906, for a process of Ore Concentration.

The opinion of the court below is found in Vol. 1, at p. clxxvii, and is reported in 245 Fed. 577 (Advance Sheets No. 4, December 13, 1917).

Appellees in this brief answer the points raised by the appellant in its brief. We feel that it is unnecessary and undesirable to do more than that herein. But we also feel that the court might like to have at hand

for ready reference a more complete and thorough consideration of the whole subject-matter, and hence we have prepared and herewith submit such in the form of a supplemental brief. Reference thereto will, when necessary, be made herein.

The subject-matter of this suit is of exceeding interest. The matter at stake is of great importance. The case below was tried with zeal and thoroughness on both sides and was considered by the court with painstaking care. The record includes the entire record in the Hyde case (Vols. 2, 3 and 4) and in addition a further voluminous record (Vols. 1 and 5 to 9).

The actual questions to be considered and decided by this court are, however, few, and can be easily and clearly stated.

Appellant's brief does not specify which of the twenty-six assignments of error (Vol. 1, p. excix) it relies upon here. Of the assignments of error its argument seems practically to be limited to the seventh (as to non-infringement since January 7, 1917), to the first (as to validity), and to the twentieth or twenty-fourth (as to disclaimer).

Its admissions simplify the issues.

It admits (page 6) that

“the Supreme Court has in the Hyde case authoritatively determined the rights of the plaintiff under the patent in suit”.

(pages 63 and 64)

“The construction of the patent has been finally determined by the Supreme Court. It is the law of the land respecting the patent in suit.”

Again (page 2):

“We admit that, under the authoritative and final interpretation of the patent by the Supreme Court, the use of oil in quantities of less than one-half of 1% (as shown by Defendant’s Exhibit No. 158, Tr. Vol. IX, p. 5184) infringed.”

This last admission of infringement covers all appellant’s flotation operations from August, 1911, to January 7, 1917, and on more than 1,500,000 tons of ore.

Appellant’s formulation of the three “questions to be decided” will be found on page 6 of its brief. They relate (1) to infringement since January 7, 1917, (2) to validity in the light of new evidence, and (3) to the disclaimer. We will limit this brief to a discussion of these three questions. Most of the discussions in appellant’s brief are academic or hypothetical in their nature and are on issues that do not arise on the facts of this case and that do not relate to any question that is before this court for decision.

INFRINGEMENT SINCE JANUARY 7, 1917.

Appellant’s contention of non-infringement includes (and stands or falls with) the proposition of law that the patent in suit, as interpreted by the Supreme Court decision, covers and includes *every oil or oily liquid that has a preferential affinity for metalliferous matter over gangue* (Patent p. 1, lines 13-15 and Claim 1, for example, p. 3, line 43).

That this *must be* appellant’s contention is evident from the fact that appellant’s procedure since January

7, 1917, involves every ingredient, step, operation and result, that its earlier (and admittedly infringing) procedure involved, (including the use of a small fraction of one per cent. of an oily liquid—pine oil—that does the work of the process), and in addition it involves the use of a large fraction of one per cent. of an oily liquid—petroleums—that does not, and cannot, do the work of the process, the two fractions when added together equalling one per cent. on the ore or more.

That this *is* appellant's contention appears on page 44 of its brief:

“Hence we see that any oily liquid having a *preferential affinity for metalliferous matter over gangue* is included within the term ‘oily liquid’ in the claim. Since there is no question but that petroleums have such *preferential affinity*, and the court below has in terms so found (*supra*, p. 41), there can be no question but that they are included within the term ‘oily liquid’ contained in the claims.” (Italics theirs.)

This construction of the patent is arrived at by mistaken emphasis upon an incidental thing and an entire failure to recognize the essential thing.

It is conceded by both parties and found by the court below that all oils possess the characteristic of preferential affinity for metalliferous matter over gangue. Comparatively few oils, however, possess the characteristic of producing a mineral-carrying froth. The soul of the invention of the process in suit resides in using an oil having the characteristic of producing a mineral-carrying froth; incidentally such oil will exhibit the characteristic, common to all oils, of preferential affinity for metalliferous matter over gangue.

To construe the patent as if the only thing sought for in the oil is its preferential affinity for metalliferous matter over gangue is to specify a characteristic which is common to all oils and therefore does not serve to distinguish the oil required; and it overlooks that which does distinguish the oil required and specifies its essential characteristic, namely, its capacity to produce a mineral-carrying froth.

One has but to read the claims and the specification to demonstrate this, viz.

(Claims 1, 2 and 3):

“agitating the mixture until the oil-coated mineral matter forms into a froth,”

(Claims 5, 6 and 7):

“agitating the mixture until the oleic acid has been brought into efficient contact with the mineral AND has formed a froth therewith”.

(Claim 12):

“agitating the mixture to cause the oil-coated mineral to form a froth,”

(Claims 9, 10 and 11):

“agitating the mixture to form a froth” [limited by disclaimer to the same mineral-carrying froth as the other claims].

It will thus be seen that the explicit requirement of every claim is that the oil or oily liquid in addition to coating the mineral particles must do the fundamentally essential thing, i. e., it must cause the oil-coated mineral particles to form into a froth.

This it does by reason of its mineral-froth-forming capacity or characteristic.

If the oil fails in this respect the process does not proceed.

If it is incapable of fulfilling this office—if it is lacking in this characteristic or power—it is not the oil or oily liquid of the claims.

The specification is equally explicit.

It sets out the discovery, the mode of operation, and the result, all as centering in the froth or scum thus constituted by the air-bubbles and their adhering oil-coated mineral particles.

And the Supreme Court decision, in upholding the patent as valid and to that end defining the process and pointing out its novelty over the prior art, specifies even more emphatically the operation of mineral-froth-formation, including the formation of a multitude of air cells, the adherence of the oil-coated mineral particles to them, the lifting of the latter by the former, and their accumulation as a floating froth, and specifies this froth as the result obtained by the process and describes it as consisting of air-bubbles modified by only a trace of oil in their films and carrying in mechanical suspension in their films a very high percentage of the mineral content of the ore.

Oils may have different characteristics. For example preferential affinity for metalliferous matter over gangue, lifting force in water, stickiness, and, in the case of the process in suit, the modifying action which re-

sults in persistent mineral-holding-froth formation. One characteristic may be utilized in one process and another in another process.

The characteristic or power of oil to form a persistent mineral-carrying air-bubble froth was first disclosed by the patentees here, and is the distinctive feature of appellees' process, and is the only explanation that has been made by any one of the process as used by appellant.

By the very necessity of the case the patent is limited to such an oil or oily liquid as will do that thing and excludes every oil and oily liquid that will not do that thing.

And the Supreme Court so confines the patent by explicit and authoritative interpretation.

This is in epitome the prescription of the patent:

Given ore, water, acid, heat and agitation nothing results.

Given ore, water, acid, heat, oil and agitation nothing may result or something may result. If the oil is an oil that, like kerosene or fuel oil, does not have the characteristic that produces mineral-carrying froth, nothing will result. If it is an oil that, like oleic acid or pine oil, does have that characteristic, an air-bubble froth will result in which the bubble-films are modified by the minute amount of oil in them and hold or carry a very high percentage of the metalliferous matter of the ore. If the ore or the oil are new and untried a simple preliminary test, says the patent, must be made to determine whether the oily substance is suit-

able under those conditions in the respect of yielding the proportion of froth or scum desired, namely: a froth or scum carrying a large proportion of the mineral present.

That this description and prescription are sufficient the Supreme Court has already held.

And this inclusion of every oil or oily liquid that will do this work and exclusion of every oil or oily liquid that will not do this work, is imported into all of the claims, as is manifest on the face of those claims as pointed out above and on the face of the disclaimer with respect to claims 9, 10 and 11.

Appellant's brief seeks to escape the fatal force of this situation by misrepresenting appellees' position.

It asserts by assumption that appellees' position is that this fuel oil and kerosene in appellant's process is wholly inactive, wholly inert, for any purpose, does not take "any active part in the process", is used "only as a diluent to increase the bulk of oil" (pp. 43 to 48).

This misrepresents appellees' position. Appellees' position is this: These oils do not possess the capacity to produce mineral-bearing froth and it is immaterial therefore on a question of infringement whether they are inactive or active, beneficial or detrimental, in other regards. Whatever action ensues from their use is incidental merely, and is negligible and immaterial on the question of infringement.

They may stabilize the froth, they may tend to prevent metal dropping out of the froth or perform some other incidental thing; but it is purely incidental.

They do not cause the process to work, and therefore they are not the "oily liquid" of the patent.

If the terms of the claims are to be construed by the real substance of the invention,—if a given ingredient is to be tested by the real work that it does in the process, or by its capacity to do, or not to do, that work,—if the claims in their use of the terms of the art are to be intelligently understood and applied from the standpoint of the end and purpose in view, the function and operation to be performed, the results to be obtained,—then the oil or oily liquid of the claims is to be interpreted and construed as such an oil or oily liquid as will do the essential work of the process, as will function and operate in the way specified in the patent, and in the claims themselves, and as will obtain the results defined in the Supreme Court decision, and to which, as that decision holds, the patent must be confined.

When you have once so construed the claims, when you have once so determined, as you must, that no oil or oily liquid is the oil or oily liquid of the claims that does not, and cannot, function and operate, and produce the result, there set out, it only remains in any particular case to determine whether the oil or oily liquid in question does in fact so function or operate and bring about the result. On this question of fact in the case of the fuel oil and kerosene used as appellant uses them the findings of the court below are clear and specific and certain, and they were based upon what was practically the concurring testimony of both sides.

And when appellant contends that an oil or an oily liquid that will not produce the results obtained by the process is nevertheless the oil or oily liquid of the claims because it has a preferential affinity for metal-liferous matter, it flies in the face of the Supreme Court decision which holds that the patent "MUST BE CONFINED" to the obtaining of those results.

Appellant's contention of non-infringement must fall with the erroneous proposition of law on which it is based that the oil or oily liquid of the claims is not limited to such an oil or to such an oily liquid as can and does upon agitation form the oil-coated mineral particles of the pulp into the froth of the patent.

Appellant's process is not only shown by the evidence to achieve substantially the same result in substantially the same way by substantially the same means, but appellant's counsel so admitted in oral argument and printed brief in the court below, saying on page 7 of "Reply to Plaintiffs' Brief" below

"Defendants' positions have been consistent throughout all the litigations. They have always consistently alleged that substantially the same results can be obtained with the use of quantities of oil larger than one per cent."

And in oral argument (see page 34 of "Oral Arguments for Defendant" below)

"Now I maintain that it has been satisfactorily proven by our witnesses, Professors Bancroft, Sadtler, Taggart and Beach, that there is no difference between the action of plus one per cent. of oil and minus one per cent. of oil in any respect that science can develop, and technically there is no difference. Our mill operations as set forth in these tabulated statements which we have introduced and in testimony of our witnesses show that there

is no difference from a technical and commercial viewpoint. It is a case in which practice and theory are in absolute agreement.”

The case for infringement might be briefly restated in the following way:

Admitting infringement for five and a half years prior to January 7, 1917, appellant, after that date, while retaining every ingredient (including a small fraction of one per cent. of pine oil, the mineral-froth-forming oil of its previous procedure) and every manipulation just as previously, has added to the ingredients a large fraction of one per cent. of certain petroleum products—fuel oil or Jones crude oil with a little kerosene—making with the pine oil a total of nearly or quite one per cent. on the ore or slightly more. The particular petroleum products thus added to the mixture, it is shown in the evidence, are not mineral-froth-forming oils, that is to say, they are incapable, when attempted to be used as the oil of the patent, of causing the oil-coated mineral particles to separate from the gangue and form into a froth. It is shown also in the evidence that when mixed with a small fraction of one per cent. of pine oil, as appellant has mixed them since January 7, 1917, they do not interfere with, or defeat, the mineral-froth-forming operation of the pine oil, but that that operation proceeds as before in substantially the same way, to produce substantially the same mineral froth and mineral froth concentrate, though of poorer grade and lower recovery and with greater losses in the tailings.

On these facts the issue of infringement arises.

Appellant does not contend that its process since January 7, 1917, is substantially different either in means, in operation, or in result, from what it was before that date, or from the process of the patent in suit. In this regard appellant merely asserts a different result in dollars.

But appellant does contend that the patent in suit is in law limited, and has by the Supreme Court been limited, in all its claims, to the use in the mixing vat of a fraction of one per cent. of oil of any and every kind, whatever its function and effect, so long as it has a preferential affinity for metalliferous matter (and indeed appellant contends that the patent has been limited to one-half of one per cent.).

On this contention the issue of infringement arises.

And it is a complete answer to this contention and a demonstration of infringement since January 7, 1917, that the patent in suit means no such thing, and the claims mean no such thing, and the Supreme Court has not so decided, but precisely the reverse.

And on this issue it is really enough to know and to note that the whole process exists for the mineral-carrying froth concentrate in which it ends. The process has no reason for being except as that mineral-carrying froth results. The entire descriptive matter of the patent sets forth a procedure by which upon agitation of a mixture of ore, air, water and oil, a floating froth is produced carrying a large percentage of the mineral matter of the ore, and the described function of the oil is to so condition the operation as that the formation

of that mineral-carrying froth results; and while the claims employ somewhat different expressions, they are all clear and identical in meaning (claims 9, 10 and 11 as limited by disclaimer) in this respect, that the oil or oily liquid prescribed to be used in the mixture is one which will upon agitation produce a mineral-bearing froth through the power of flotation of air-bubbles which have the oil-coated mineral particles adhering to them.

And it is sufficient answer to know and to note that the Supreme Court in the Hyde case decided that the confining of the claims of the patent to the obtaining of this resulting concentrate, this mineral-carrying air-bubble froth, which the court defines, gave the patent validity, and that this result so obtained by the use of the mineral-froth-forming oil differentiated the process, and the principle of the froth-formation differentiated the process, from all processes in the prior art, and it is this froth thus produced that is the identifying earmark of the invention.

It is clear to a demonstration that the oil or oily liquid of the patent is and must be a mineral-froth-producing oil, and that the Supreme Court decision, whatever else or whatever more it has secured to the appellees, has secured to them the monopoly under the patent in suit of the use in the procedure of the patent of such a mineral-froth-producing oil in an amount at least up to one per cent. on the ore.

And that is as far as the Court need go in holding infringement, for appellant since January 7, 1917, has

used only a small fraction of one per cent of mineral-froth-forming oil.

We will now take up the argument more in detail.

THE APPELLEES' PROCESS.

The patent in suit is for a process of ore concentration by air-froth flotation. It was the first successful process of ore concentration by air. The fact that air bubbles would pick out and select mineral or metal particles and reject gangue had been observed, but no one had succeeded in utilizing it. In the practical work of ore concentration fugitive and accidental occurrences of this phenomenon had been considered as a cause of "much trouble in ore dressing" and "rather as a difficulty to be overcome than as a help" (Vol. 8, p. 4397*).

The essence of the invention in suit is the employment to that end of a mineral-froth-producing oil which modifies the water of an ore pulp in such a way that upon agitation an air-froth flotation of the oil-coated mineral matter results. Later (1909) it was discovered that other materials, not oils, such as alcohol and acetic acid, had this water-modifying and mineral-froth-producing quality, but at the time of the invention in suit the achieving of a mineral-froth-producing operation and consequent air-froth flotation was wholly novel, and the patent in suit is the pioneer patent for a process wherein this air-froth flotation is achieved. The patent in suit with respect to oils is limited to oils that have this min-

*The references in this brief are to the printed Transcript of Record unless otherwise noted.

eral-froth-producing characteristic that evokes air-froth flotation of the mineral. The selective affinity of air bubbles for mineral particles in the body of an ore pulp may occur in the absence of a mineral-froth-producing substance but no useful air-froth flotation of the mineral can be produced. For example, air bubbles in pure or unmodified water select and strongly attach to themselves the mineral particles, and reject the gangue particles, but in such unmodified water the bubbles forming larger bubbles which, when they reach the surface, burst or explode violently and drop the mineral particles, and the operation is useless for the concentration of ores. In the process in suit, however, the modifying action of the mineral-froth-producing oil tends to prevent coalescence of the submerged bubbles or air cells. It makes little bubbles and keeps them little. They repel each other and repel gangue while attracting mineral, and this has suggested electrical theories to explain the process. The little air bubbles coursing through the mass of ore pulp select, pick out and attach to themselves the mineral particles, and when permitted float upward through the pulp. When they reach the surface they emerge as air bubbles having thin bubble films firmly holding the mineral particles, and these bubble films do not burst but persist and the bubbles accumulate into a floating froth layer which carries the mineral. This froth layer may be many inches in thickness. The bubbles in it are so persistent under some circumstances and conditions that the froth has been called permanent, and it is always persistent enough to be readily separated from the

water on which it floats without the mineral particles dropping back into the water. A few of the bubbles may expand, or may burst and drop their mineral, but the mineral is caught and held by the lower bubbles in the froth.

THE APPELLANT'S INFRINGEMENT.

Since January 9, 1917, the appellant has added to the small fraction of one per cent. of pine oil that it had previously used (and that it has still continued to use) a large fraction of one per cent. of fuel oil (or Jones crude oil) and kerosene, making the total of oils of all kinds in the mixture (there was occasionally some other oil present) vary from somewhat below to a little above one per cent. on the ore. The actual daily quantities used averaged as follows:*

	Pine Oil		Petroleums	Total	
	Lbs.	%	Lbs.	Lbs.	%
Jan.-Dec., 1916	1.43	.07	0	1.43	.07
Jan. 9-31, 1917.....	1.51	.075	11.93	14.75	.738
Feb. 1-28	1.90	.095	16.25	19.33	.967
Mch. 1-31	2.82	.141	18.77	22.08	1.11
Apr. 1-15.....				23.91	1.19

The petroleums added were oils; but when used by themselves, in any quantity, large or small, alone or together, they were ineffectual in the process. No mineral-carrying froth was formed and no concentration achieved. When used with pine oil mineral-carrying froth was formed and concentration achieved.

The mineral-carrying froth produced by appellant's process with the petroleum oils so added was substantially the same in character and kind and quantity as

* See Supp. Br. pp. 126 et seq.

the froth had been before. It was produced in substantially the same way, by substantially the same operation, and by substantially the same means. Take the pine oil away from the process and the froth disappears. Restore it and the froth reappears. Take away the petroleum oils and the froth remains unchanged. Restore them and the froth remains unchanged (Supp. Br. pp. 132-136).

The grade of the concentrate was lowered when the petroleum oils were present (a 53% grade in 1916 became 47%, this meaning that there was more gangue in the concentrate); simultaneously the recovery was lowered (a 92% recovery in 1916 became 83%); and the tailings losses increased (a 1.24% zinc loss in the tailings in 1916 became 2.79%); the cost of the operation was increased (a cost of \$0.82 per ton of ore in 1916 became \$1.34); and so much return of middlings for retreatment was required that the total mill capacity was notably diminished (Supp. Br. pp. 136-138).

That infringement is obvious on substantially undisputed facts as to this process of appellant's, and that a holding of infringement is inevitable on the narrowest construction that could in law be given to the patent and inevitable on the Supreme Court decision, will, we believe, become manifest as we proceed, if it is not already manifest.

THE PATENT IN SUIT AND THE SUPREME COURT DECISION.

The patent recites the discovery that when in the Cattermole process the proportion of oily substance

was “considerably reduced—say to a fraction of one per cent. on the ore—” (p. 1, line 31)—granulation ceased and after vigorous agitation there was a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum (whereas had granulation not ceased it would have sunk to the bottom in the form of granules). Manifestly if the oily substance that was being employed had chanced to be such that the metalliferous matter coated by it did not rise after agitation and form a froth, the discovery would not have been made (*infra*, p. ~~80~~⁸¹).

The patent after certain general observations, all addressed to the formation of the new froth and the best conditions to bring about the flotation “in the form of froth” of “the proportion of mineral” desired (p. 1, line 61), gives an example of the application of the invention to the concentration of a particular ore (p. 1, line 70), and in that example specifies “oleic acid” which will in fact form the metalliferous matter into such a froth and which is therefore a mineral-froth-forming oil, and describes as the operation and effect when agitation is stopped (p. 1, line 89), that “a large proportion of the mineral present rises to the surface in the form of a froth or scum” and gives the minimum amount of oleic acid (p. 1, line 96) “which can be used to effect the flotation of the mineral in the form of froth”. Further on in the specification in describing an alternative method for the recovery of any sunk oiled metalliferous matter the patent says (p. 2, line 112) that

“the bubbles of ~~oil~~^{air} or other gas so generated throughout the mass at once sweep to the surface thereof all the metalliferous matter in the form of a froth which can be separated as before.”

And again (p. 3, line 27)

“The whole of the mineral to which air bubbles are attached—say the oiled mineral—at once rises to the surface as coherent scum or froth.”

At page 1, line 105, speaking of the first example the patent says

“The froth may contain about 70% to 80% of the metalliferous matter present in the ore.”

and immediately after (p. 2, line 3)

“the oil-coated metalliferous matter removed as froth is separated etc.”

Clearly *the forming of the oil-coated mineral matter into the froth* is the very essence of the operation and the froth itself into which the oil-coated mineral matter is formed is at once the end sought by the process and the visible sign and evidence that the process has proceeded.

Clearly also the oil that gives it life must be an oil that will so form the oil-coated mineral particles into a froth. And it is equally clear that an oil that will not do that thing, an oil that while having a preferential affinity for mineral matter and coating the mineral particles will not upon agitation form them into a froth, is not the oil of the process or of the patent.

The claims are equally explicit. While some of them specify “an oily liquid having a preferential affinity for metalliferous matter” they do not stop there, but

require also that "the oil-coated mineral matter forms into a froth" or words to that effect.

Claims 1, 2, 3, 5, 6, 7 and 12 are alike in the limitation that it is *the oil-coated mineral matter* that forms into the froth, and claims 9, 10 and 11 are alike in the omission of this limitation, so that before disclaimer the froth of claims 9, 10 and 11 did not require, so far as the phraseology of those claims was concerned, to be formed by the oil-coated mineral matter. In other words, it need not have been a mineral-carrying froth. The disclaimer, however, aligns claims 9, 10 and 11 with the other claims in this regard in limiting them to the obtaining of the same result, namely, the same mineral-carrying froth to which the other claims are limited.

The Supreme Court in the Hyde case found that the mineral-carrying froth formed upon agitation by the oil-coated mineral particles of the mixture was a result novel with the patentees and was achieved by the use of a bubble-modifying and froth-forming oil and differentiated the process in that way from all processes of the prior art.

The Supreme Court found that the process formed "a multitude of air cells," (p. 6)* the buoyancy of which air cells chiefly constituted the lifting force which separated the metalliferous particles of the pulp from

*References in this brief to the Supreme Court opinion will be to the pages of the pamphlet opinion as published by the Supreme Court.

Unless otherwise noted, bracketed portions and italicizing in quotations will be ours.

the other substances of it (p. 5) and "floated them to the surface" (p. 5) and there formed this **froth** (p. 3) composed "of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles"—**"a result never obtained before"** (p. 5).

The Supreme Court said that the experimenters were working on the Cattermole "Metal-Sinking process" as a basis "when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. 'on the ore'"; that as the oil was further reduced there was an increase in the amount of "float froth" which reached its maximum at about one-tenth of one per cent. of oleic acid "on the ore"; that (p. 7) "it was while engaged in study of prior kindred processes [Cattermole, etc.] that their discovery was made"; that while they discovered the final step which brought success "yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the *results obtained* by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of one per cent. on the ore'" (p. 8).

It is clear that the word "results" as used in this concluding paragraph of the opinion (p. 8): "the patent must be confined to the results obtained," etc., is used with reference to the product of the process, the visible

thing that is formed or made or produced or effected by it—viz. the mineral-carrying air-froth.

The district court in the Hyde case had held that the result or product of the process in this sense, the air-froth holding the mineral particles, was a novel result, and that the principle or mode of operation by which that result was obtained was novel, and therefore (and not because of the mere economy in oil), it had sustained the invention as patentable and the patent as valid.

This Court in the Hyde case had found the fact to be that the result, the froth concentrate, the product of the process, was not novel but was old, and that the principle or mode of operation by which it was formed or produced was old, and that the only novel thing was the mere economy in oil, the arbitrary reduction as such in the amount of oil used; and on that finding of fact, and with entire soundness as a proposition of law, this court had held that no invention was involved and that the patent was invalid.

The Supreme Court had these two decisions before it for review. The one decision found the novelty of the process in what came out of it, the result produced by it. The other decision found no novelty in that, no novelty in the principle or mode of operation, and novelty only in the arbitrary reduction in the quantity of an old ingredient (oil) that went into the mixing vat at the beginning of the process. Had the Supreme Court agreed with this court on the facts it must have agreed on the law. But it agreed with the district court on the facts,

and based its holding of validity upon the novelty of the mineral-carrying froth obtained by the process, and confined the patent so that no claim of it should extend beyond, or cover anything beyond, that result. Its condemnation of claims 9, 10 and 11 was because they extended beyond those confines. It was asked to so confine those claims by construction, but it did not do so (Supplemental Brief, p. 286). The disclaimer, however, disclaims all the excess that extended those claims out beyond those confines, and it therefore aligns them also with the court's decision.

The most conspicuous fact in this whole decision is the emphasis given to the mineral-carrying froth—the result obtained by the process—and to its novelty. We have seen how the patent emphasizes that froth. The decision makes it the very life of the process and its novelty the very basis of the patent.

To argue, as appellant must, that any oil is the oil of the process and patent which has a preferential affinity for metalliferous matter whether it is capable of obtaining the results specified by the Supreme Court or not, is to fly in the face of that decision. The use of a fraction of one per cent. of an oil that is incapable of producing the specified results could not be within the patent, for the patent has been confined to those results, and such an oil, therefore, is not the oil of the patent under the decision.

The mixture, which is to be agitated, is to be composed of ore, water, air, acid or not, heat or not, and oil or oily liquid. The agitation is to be continued

“until the oil-coated mineral matter forms into a froth” (claims 1, 2 and 3), until the oil and the mineral have “formed a froth” (claims 5, 6 and 7), “to cause the oil-coated mineral to form a froth” (claim 12), to form the same mineral-carrying froth (claims 9, 10 and 11, as limited by disclaimer).

If you omit oil or oily liquid, the other ingredients will not, upon agitation, form a mineral-carrying froth. The process will not be embodied. If you include oil or oily liquid, the agitating of the mixture may or may not form the mineral-carrying froth desired. If it does not form a mineral-carrying froth, then you have not used the oil or oily liquid prescribed by the patent. If it does form a mineral-carrying froth, then you have used the oil or oily liquid prescribed by the patent.

This is the sole, single and determinative test, both as to the quality and as to the quantity of oil to be employed.

A process of ore concentration must give a larger proportion of mineral to gangue in the resulting concentrate than there was in the original ore—that is the whole object of the process—otherwise no concentration whatever has been effected. The patent says (p. 1961):

“The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances, and before utilizing the facts above mentioned in the concentration of any particular ore, a simple preliminary test is necessary to determine *which oily substance* yields the proportion of froth or scum desired.”

You must select an oil, not any oil, or all oil having general undefined oily qualities or specific qualities of other kinds, but oil which will, when added to the mixture, upon agitation, form a mineral-carrying froth having the desired greater proportion of mineral to gangue than the original ore had—an oil that will concentrate mineral by air flotation.

If you select an oil that will not form such a mineral-carrying froth, it is an immaterial and negligible thing, so far as this process is concerned, that it happens to be denominated oil, or that it happens to have other characteristics of oil. So far as this patent is concerned it is *not oil*—that is, no oil is “oil” or “oily liquid” within the meaning of the claims of the patent in suit unless, when added to the mixture, it produces upon agitation a mineral-carrying froth.

Placing, therefore, the narrowest and strictest construction upon the decision of the Supreme Court in the matter of the amount of oil used, we find that the patent in suit covers *at the very least*, any and every process in which ore, air and water are mixed with a *mineral-froth-forming oil* used in an amount which is a fraction of one per cent. on the ore, and in which the mixture is agitated until a froth is produced carrying a large percentage of the metalliferous content of the ore.

The Supreme Court decision, in legal effect, goes much further, as we believe; but for the purposes of deter-

mining the issue of infringement in the case at bar, it is not necessary to determine that further question, and any determination of it here would be outside the issues of the case, and so unnecessary.

If that issue arose on the facts (as it does not), we would submit with complete confidence in summary as follows: (For fuller discussion see Supp. Br. p. 275).

The Supreme Court,—calling attention to the fact that the patentees were engaged in study of the kindred Cattermole “Metal-Sinking Process” with the special purpose in mind at the time to trace the effect *on the results* of the process of a reduction to the vanishing point of the quantity of oil used, whereupon, at about one-half of one per cent. on the ore, the Cattermole results vanished and on further reduction results unknown before supervened and on still further reduction vastly increased and the discovery in suit was made,—found that the patentees took the last and successful step and thereby obtained *new results never obtained before*, and the decision supported the patent as valid because the results obtained were new, but confined the patent so that it should not cover or include any process obtaining the old results. Had the Supreme Court found that the carrying novelty lay only in a certain quantitative relation of the amount of oil used to that previously used, it would have confined the patent to that quantitative relation; but it found the carrying novelty in the results obtained, and confined the patent to them—sustaining the patent, not as a patent for a result *per se*, but as a patent for a novel process, distinguished by the

novel results it obtained, and identifiable by those novel results. The Court said (p. 7): "The composition of ores varies infinitely, each one presenting its special problem" and supported as sufficient the patent's prescription of a simple preliminary test with each new ore and each new oil to determine among other things "the amount of oil" (p. 7) that will obtain the resulting froth concentrate desired.

This was a most explicit and emphatic holding that the real substance of the invention is to be considered and that it is to be judged by its works, identified by the results obtained, and not by any arbitrary quantitative reduction in the amount of oil used in the mixing vat for that might vary with every ore and with every oil. Reduction was functional, but no specific reduction was necessarily limiting.

Judge Bradford in the Miami case had declared claim 9 invalid because it was not limited to the use of a fraction of one per cent. of oil on the ore. In sharp contrast the Supreme Court, with Judge Bradford's decision before them, held claim 9 (and claims 10 and 11) invalid because they were not confined to the results obtained by the process as defined by the court. This different attitude, in the opinion of the Circuit Court of Appeals in the Miami case, "acutely enlarged" the question of infringement.

We are now in a position to take up the first question on the facts, which is:

DID THE APPELLANT, BY THE OPERATIONS WHICH IT CONDUCTED FROM JANUARY 7, 1917, UP TO THE TIME OF TRIAL, INFRINGE CLAIMS 1, 2, 3, 9, 10, 11 AND 12 OF THE PATENT IN SUIT (CLAIMS 9, 10 AND 11 AS LIMITED BY DISCLAIMER)?

The answer to this question depends upon whether appellant practiced throughout that period the process described in the patent and decision.

The court below found the fact to be that the appellant during the period in question had made *beneficial use* of only a fraction of one per cent. of oil on the ore. That was tantamount to a holding of what was the actual fact that the appellant made use of only a small fraction of one per cent. of an oil that was capable of beneficial service in the process, i. e. effectuating air flotation and obtaining the results specified by the Supreme Court.

The appellant throughout the period in question, used a mineral-froth-forming oil (pine oil) in an amount less than one per cent. on the ore (*supra* p. 16), and agitated the mixture until a froth was formed carrying a large percentage of the metalliferous content of the ore. The presence in the mixture of another oil in an amount such as to bring the total of both kinds of oil up to one per cent., or more, on the ore (but the other oil carefully selected after a long search just because it would not defeat froth formation by a true mineral-froth-forming oil), did not change in kind the results that were obtained, or the principle of action or mode of operation by which they were obtained, or the means by which they were obtained.

Appellant's argument of limitation to one-half of one per cent. of oil.—So much of the argument of the appellant as seeks to avoid the charge of infringement, by claiming that the Supreme Court decision restricted all the claims of the patent in suit to one-half of one per cent. or less of oil in the mixture, is unworthy of serious consideration. The specific example of a particular ore—Broken Hill ore—and a particular oil—oleic acid—given in the patent at page 1, lines 70 to 101, in illustration of “the application of this invention to the concentration of a particular ore” (that happening to have been the particular example worked out by the patentees when the discovery was made), is so limited to one-half of one per cent. of oleic acid on the ore, as Mr. Kenyon pointed out to Mr. Justice McReynolds in his oral argument in the Supreme Court in historically describing the making of the discovery. Claims 5, 6 and 7, of the patent, which are apparently addressed to that particular example, or others like it, are so limited. But the case is different with the general description in the specification (outside of that particular example), and with claims 1, 2, 3, 9, 10, 11 and 12 of the patent. In the case of the particular example of Broken Hill ore and oleic acid, the limitation to one-half of one per cent. of oleic acid on the ore is not arbitrary, but is functional. It arises from the observed fact (set out in the evidence in the Hyde case) that that quantity of oleic acid, under the described conditions, substantially marked the boundary or divide above which the Cattermole granulation operation results were obtained, and below which

the patentees' flotation results were obtained. And so in any other specific case of another ore and the same or another oil, and the same or other conditions of heat, of acidifying, of agitation, etc., a similar simple test would determine the required proportions and the boundary line within which the patentees' results would be obtained. There is no magic in any particular per cent. or quantity apart from accompanying conditions. The Supreme Court did not commit what would have been the manifest error of limiting the confines of the invention in general (covering all possible applications) to those of a particular example and a single application, where it knew and said that ores varied infinitely and each was a problem by itself. On the contrary, the Supreme Court decision adopted a logical and reasonable test which is inconsistent with any hard and fast quantitative test—the logical and reasonable test of “the results obtained,” which results it concretely described and which it found to be new with the patentees.

Appellant's argument that any oil is the oil of the patent.—The only other contention made by appellant with respect of non-infringement, is equally illogical and unreasonable and baseless. It is, that when the patent in suit prescribes an oil or an oily liquid, it means rigidly and absolutely and without exception, every oil that has a preferential affinity for metalliferous matter over gangue, whether it would form a mineral-carrying froth upon agitation or not, i. e. any and every oil whatever. Thus appellant's brief says, on page 44:

“When we come to the claims we find that they define the oil as ‘*an oily liquid having a preferential affinity for metalliferous matter.*’

Hence we say that any oily liquid having a *preferential affinity for metalliferous matter over gangue*, is included within the term “oily liquid” in the claim. Since there is no question but that petroleums have such *preferential affinity*, and the court below has in terms so found (*supra*, p. 41) there can be no question but that they are included within the term ‘oily liquid’ contained in the claims.”

This contention ignores the fact, as we have already pointed out, that the claims specify that the agitation of the mixture is to be continued

“until the oil-coated mineral matter forms into a froth” (claims 1, 2 and 3).

And again:

“Agitating the mixture to cause the oil-coated mineral to form a froth” (claim 12).

and,

“agitating the mixture to form a froth” (claims 9, 10 and 11).

which latter are limited by disclaimer to the results obtained by the process described; namely, the mineral-carrying froth.

That the particular petroleum products added by appellant in order to bring its total oil mixture up to or above one per cent. on the ore, do not function and are incapable of functioning, as mineral-froth-forming oils, is shown in this case by overwhelming evidence, and is found by the court below as a fact.

Appellant's contention that the claims all cover and include any oil (for all oils have such preferential affinity), ignores the perfectly plain requirement set forth in the specification and in every claim of the patent, and can only be advocated in argument or adopted in decision, by absolutely eliminating from the process its only vital feature and factor, the air-lift and air-froth carrying the oil-coated mineral particles, which alone the Supreme Court found to be novel and to give life to the invention and validity to the patent.

Moreover such a contention flies in the face of the Supreme Court decision which has confined the patent to the results described and so, by necessary effect, to oils that will effectuate those results.

The vital feature and factor of the process—the thing which constituted its novelty—was not the mixture of air, water, ore and any oil, and agitating such mixture. In the case of a great many oils which have a preferential affinity for metalliferous matter over gangue (all oils have that to some degree) agitation with such ores as have been tested will not form a mineral-carrying froth though it were continued till doomsday. In such a case the agitation of the mixture would not be the process of the patent in suit or obtain the results of that process or be any process of ore concentration. It would be outside the patent by the explicit holding of the Supreme Court decision. In claims 9, 10 and 11 there is no specific mention of the preferential affinity of the oil for metal-

liferous matter, but those claims as now limited by disclaimer, as well as the other claims of the patent, all have the basic and fundamental limitation buttressed by the Supreme Court decision that the agitation of the mixture must cause the oil-coated mineral to form the froth, and therefore necessarily that the oil contained in the water to that end must be a mineral-froth-forming oil.

In all the claims of the patent, as well as in the specification, the characteristic of oil that is to be utilized, the characteristic which the patentees discovered and for which they use the oil in the mixture, is set forth with entire clearness and beyond the possibility of doubt or misunderstanding. That characteristic is the characteristic that causes it, under agitation, to coat the mineral particles and *to cause THEM to form into a froth*. The "oil" or "oily liquid" with which this invention and this process and this patent deal, is solely and only such oil as has this characteristic. And if a simple test is required to determine whether a given oil has this characteristic, that test, under the prescription of the patent, can and should be made, and the Supreme Court has decided that under the circumstances of this case, that prescription in the patent is sufficient. And so far as all experience to date shows the world over, when that characteristic is found in any given oil, the quantity of that oil that is necessary to develop that characteristic effectually, is a fraction of one per cent. of oil on the ore, and generally a small fraction of one per cent.

Mere addition does not avoid infringement.—When appellant seeks to avoid the charge of infringement by claiming that its process is outside of the patent because, while adding a small fraction of one per cent. of a mineral-froth-forming oil, it also adds other oils which after several years of investigation it has discovered are not mineral-froth-forming oils, making the aggregate of mineral-froth-forming oil plus the non-frothing oil more than one per cent. on the ore, it makes an irrelevant and futile contention, wholly unwarranted and unjustified by any principle of construction of patents and contrary to common sense and the Supreme Court decision.

When the terms “oil” and “oily liquid” of the claims in issue and of the specifications by which those claims are explained, are once understood in the light of the operation that proceeds and of the results that are obtained, any other kind of oil, that is to say, any kind of oil lacking the essential characteristic so defined, is, so far as the patent in suit is concerned, not the “oil” or “oily liquid” of the claims, and is, so far as the patent is concerned, just as if it were not oil at all but some other liquid. When you determine, as you must, that the “oil” or “oily liquid” of the patent is a mineral-froth-forming oil that will do the work described in the patent and effectuate the process there set out, then any and all other oils lacking that characteristic (and regardless of other characteristics they may have) are not to be considered as oils with respect to this process, and their use in large or small or any quantity, can in no wise affect the question of infringement.

There is no principle of patent law better established and more firmly settled than that infringement exists if the substance of the patented process is taken without leave, no matter what other and additional things may also be used. One none the less uses the patented process, notwithstanding he also uses something else with it.

As the Supreme Court said in *Tilghman v. Proctor*, 102 U. S. 707, if the patented process

“modified or unmodified by the supposed improvements, underlies the operation performed”—“forms the basis of it”—“it is idle * * * to say that they do not infringe.”

And again,

“The introduction of an improvement gives no title to use the primary invention upon which the improvement is based.”

As was said by an English court in *Proctor v. Bennis*, L. R. 36 Ch. Div. 740, quoted with approval in *Morley Sewing Machine Co. v. Lancaster*, 129 U. S. 263,

“* * * it is obvious that additions may be an improvement, and that omissions may be an improvement, but the mere fact that there is an addition, or the mere fact that there is an omission, does not enable you to take the substance of the plaintiff’s patent. The question is not whether the addition is material, or whether the omission is material, but whether what has been taken is the substance and the essence of the invention. That seems to me to be the true test, as propounded by the House of Lords in *Clark v. Adie*, L. R. 2 App. Case. 315, 320.”

In *Von Schmidt v. Bowers*, 80 Fed. 121, this court said:

“all subsequent machines which employ substantially the same means to accomplish the same result are infringements, notwithstanding the subsequent machine may contain improvements in separate mechanism which go to make up the machine.”

In *Stebler v. Riverside Orange Growers' Association*, 205 Fed. 735, this court again said:

“One who appropriates another’s patented invention, even though he may add thereto another element to perform an additional function, is guilty of infringement.”

Even where the defendant’s embodiment is less efficient or less economical than the plaintiff’s, the same rule applies.

Thus the Supreme Court said in *Winans v. Denmead*, 15 How. 330:

“it is not necessary that the defendant’s cars should employ the plaintiff’s invention to as good advantage as he employs it, or that the results should be precisely the same in degree. It must be the same in kind, and effected by the employment of his mode of operation in substance.”

Again the Supreme Court said in *Hobbs v. Beach*, 180 U. S. 383:

“The fact that the Horton device contains no mechanism for turning the strip into the inside of the corner, merely indicates that it does not perform all of the functions of the Beach patent. But it is no less an infringement if it performs its primary function in practically the same way. We are not concerned with the subordinate differences in the mechanism, least of all with the different names given by Horton to parts of his machine similar to the corresponding parts in the Beach patent. As the two machines are alike in their functions,

combination, and elements, it is unnecessary to go further and inquire whether they are alike or unlike in other details."

Just as in that case a difference in names for identical parts made no real difference, so in the case at bar, identity of names for essentially different ingredients can make no real identity.

In *Consolidated Safety Valve Co. v. Crosby Co.*, 113 U. S. 157, the Richardson valve was of such a structure that all the steam which escaped into the open air had to pass through a peculiar stricture which was the novel thing. In the defendant's valve only a part of the steam passed through the defendant's stricture. But the court held that although this was an inferior construction yet the difference was one of degree and the defendant to the extent that its steam escaped through the stricture got Richardson's advantage and by the same mode of operation and so infringed.

In *Letson v. Alaska Packers Association*, 130 Fed. 129, this court said

"it is unimportant that the appellants do not accomplish by their plunger all that is accomplished by the appellee's. The two devices are the same and the appellant cannot avoid infringement by failing to make use of the upper plunger for all purposes for which it might be used."

As was said by the Circuit Court of Appeals for the Fourth Circuit in *Crown Cork & Seal Co. v. Aluminum Stopper Co.*, 108 Fed. 845:

"The court will look through the disguises, however ingenious, to see whether the inventive idea of the original

patentee has been performed and whether the defendant's device contains the material features of the patent in suit."

The claims of the patent in suit, so far as the use of oil or oily liquid is concerned, define clearly, distinctly and imperatively what must be used, i. e., an oil that is capable of producing a mineral froth under the conditions of its use—and for the purposes of the only question of infringement presented in this suit, we may deal with the patent just as if it were restricted in terms to a fraction of one per cent. of such an oil upon the ore.

To determine infringement, therefore, is a perfectly simple matter and requires only the consideration of a fact. The only fact (if the procedure of the patent is otherwise used) that needs to be considered is, how much mineral-froth-forming oil is being used to form the froth. When the investigation discloses that the quantity of mineral-froth-forming oil is a fraction of one per cent. on the ore and that the results specified by the patent and the decision are obtained, infringement exists even on the strictest and narrowest construction of the claims. The infringer, upon this state of facts, can no more successfully resist the charge of infringement by saying, "But I also used other oils making in the aggregate of all kinds of oil more than a fraction of one per cent. on the ore," than if he should say, "In addition to the fraction of one per cent. of mineral-froth-forming oil which I used, I also used some acids or some solids or liquids of various kinds and with various names and functions."

It is impossible to add apples and pears and get an aggregate of apples.

It is utterly immaterial upon the issue of infringement in this case (even assuming the narrowest construction of the claims) what non-frothing oils or what other things are used, if the user employs the procedure of the patent in suit and in that procedure uses a fraction of one per cent. of mineral-froth-forming oil, and obtains the results specified in the decision.

The appellant is in just this position, and the whole situation on the issue of infringement is luminously clear.

The Findings of Fact Made by the Court Below on the Issue of Infringement.

The court below, facing all the witnesses who testified on the facts, and personally viewing the many experiments and tests that were made in court during the progress of the trial, and viewing the two processes in the mill (appellant's and appellees') on the last day of the trial, the one at the appellant's mill and the other at the Timber Butte mill (one of appellees' licensees) found the following facts:

that

“the larger part of the oil used by the defendant and all in excess of a fraction of one per cent. on the ore, if not inert is ineffective, wasted and injurious to the process and results” (Vol. 1, p. xcii);

that the petroleum oils which constituted a large part of the oils

“seemed generally ineffective by the evidence of both parties” (p. xciii);

that these petroleum oils

“are ineffective to operate the process and that is because they have not the quality that contributes to bubble-making. * * * With these ineffective oils agitation will not produce froth and so there is no flotation of the metallic particles” (ib.);

that

“Defendant uses the patent process, uses plaintiffs’ invention of ore concentration by air-bubble flotation, uses the same elements in the same combination in the same way with the same function to the same, but poorer results” (p. cxci);

that

“The addition of the excess oil no more adds to or changes the process, no more avoids infringement than would the addition of milk or other useless substance not a part of the process” (p. exciv);

and that the excess oil was added

“merely to avoid the patent” (ib.).

The Evidence.

These findings of fact by the court below were based upon credible testimony of reputable witnesses produced by both parties—practical experts in this art such as Mr. Greninger, Mr. Chapman, Mr. Higgins and Mr. Wiggin for appellees, who not only testified to their observations and opinions, but some of them made practical demonstrations of the facts in court; also Mr. Engelmann of the Ray Consolidated Company, a practical expert in this art produced by appellant, who testified to mill tests*, and Professors Ban-

*“We tried at different times to run on straight fuel oil, but we could never maintain metallurgical results” (Vol. 6, p. 3255, Q 78).

croft, Taggart and Beach, scientists produced by appellant, and Messrs. Wilding and Wilkinson, practical experts who interpreted for the court appellant's tabulated statements and monthly reports as to its procedures both before and after January 7, 1917.

Mr. Higgins for appellees demonstrated by a test carried on in open court that a mixture of fuel oil and kerosene (two of the three components of appellant's mixture) in an amount aggregating 18 lbs. to the ton (fairly typical of appellant's mixture), when added to a mixture of ore, water and acid, would not upon agitation produce a mineral-carrying froth or effectuate any ore concentration whatever, but that when to that mixture of ore, water, acid and 18 lbs. of fuel oil and kerosene, 4 lbs. of pine oil per ton of ore was added and the same identical agitation repeated, a copious mineral-carrying froth was produced, and ore concentration was effected (Vol. 8, p. 4608, Qs. 424-426; p. 4611, Qs. 444-447; p. 4613, Qs., 458-466). Mr. Higgins made a similar demonstration, trying first 2 pounds of kerosene with ore, water and acid, which upon agitation gave nothing whatever in the way of a metal-carrying froth, and to which he then added 2 lbs. of pine oil per ton of ore and repeated the agitation, whereupon a good mineral-carrying froth was produced (Vol. 8, p. 4603, Qs. 407-419).

Some of appellant's witnesses testified to sporadic mill operations said to be with petroleum alone, but they were discredited and the operations shown not to have been with petroleum alone (see cross-examination of Janney, Vol. 5, p. 2612, XQs. 349-408, and p. 2627, RXQs. 432-446;

and Supp. Br., pp. 114-116). Janney admits knowing many oils that will not froth and another class that will froth and make the bubbles stable (Vol. 5, p. 2576, Q. 158). Professor Bancroft, one of appellant's scientific witnesses, repeatedly says that kerosene is not a frothing oil and selects it as the typical non-frothing oil (Vol. 6, p. 3145, Q. 24, p. 3153, Q. 50; p. 3154, Q. 51) and says of appellant's mixture that it contains (1) the non-frothing viscous oil, fuel oil (2) kerosene, which he had selected as the typical non-frothing oil, and (3) pine oil which is a frothing oil.

Appellant's brief (page 45) apparently seeks to suggest, by italicizing the words "kerosene" and "alone" in the phrase "kerosene acid sludge alone" that the Anaconda Company as appellees' licensee sometimes uses kerosene alone in its great flotation operations. Kerosene acid sludge is not kerosene at all, but a by-product of the refining of kerosene, and it contains no kerosene (Vol. 8, p. 4317, Qs. 110-112). Mr. Wiggin says also (and this may help explain where some of the large amount of inert and useless petroleum oil goes to in appellant's process) that the Anaconda Company has found that aluminous clay material in the copper slime probably absorbs some of the oil used rendering that much of the oil useless for flotation, this explaining why it is found necessary to use more oil with the copper slime (Vol. 8, p. 4300, Q. 33). Appellees' witnesses speak of the great excess of clay gangue slime in appellant's ore and of the probably large absorption of fuel oil and kerosene thereby, and the reports of appellant's mill superintendent (Vol. 9,

p. 5292-5301) show that of every 26.37 lbs. of oil added in the demonstration mill run on April 29, 1917, more than 10 lbs. were found running to waste in the tailings where of course the proportion of gangue is large.

That the appellant's procedure since January 7, 1917, is substantially the same process, proceeding by the same identical operation to the same identical result—the metal-carrying froth—is testified to positively by the practical experts Greninger (Vol. 8, p. 4326, Qs. 14-19, 22), Chapman (p. 4435, Q. 37) and Higgins (p. 4735, Qs. 34-36) produced by appellees, and counsel for defendant below stated that it had been satisfactorily proven by his witnesses, that the same results are obtained with over one per cent. as with under one per cent. of oil and that the operations of defendant demonstrated this. He particularly referred to his witnesses, Professors Bancroft, Sadtler, Taggart and Beach (see *supra*, citations p. 10). A typical statement will be found in the testimony of Professor Beach (Vol. 6, p. 3068, Q. 55; p. 3122, XQs. 228, 229).

Appellant's brief cites no evidence or opinion to the contrary, and the appellant in its brief here seeks the benefit of an argument to escape conviction of infringement by intimating or suggesting that it obtained by its operations a different result from that obtained by the process in suit. It cites no evidence to sustain this argument. It points out no difference whatever between the principle and mode of action and operation of the process as carried out after January 7, 1917,

and as carried out for five years before that date, nor any difference whatever in the product of the process, the resulting froth concentrate. The argument, therefore, not only lacks any basis in fact to support it but is in direct opposition to the testimony of the witnesses on both sides. The whole effort of the defendant in the court below was directed at proving that the results obtained by large quantities of oil in the aggregate above one per cent. were identical with the results obtained by quantities below one per cent., and its counsel urgently insisted there that the defendant had established this fact.

However effective the argument now made might have been, if the facts of the case had supported it, it is utterly futile because the facts do not support it but on the contrary destroy it.

The case is well within the rule that was stated in the opinion in *Butte & Superior Copper Company* against *Clark-Montana Realty Company* and *Elm Orlu Mining Company*, filed at this term by this court.

“There are several assignments of error to the findings of fact, * * * The appellant does not assert that the findings of fact are unsupported by competent evidence, he contends that they are contrary to the weight of the evidence. The trial court made its findings upon an evidently careful and painstaking investigation of the testimony and the exhibits, and after a personal inspection of the mining properties. We have examined the record sufficiently to see that the findings are all supported by the credible testimony of reputable witnesses. Upon settled principles which this court has always recog-

nized, findings so made upon conflicting testimony are conclusive upon this appeal.”

We have on the facts here a perfectly clear case of a user of the exact process of the patent in suit who seeks to escape the charge of infringement by adding thereto something other and different that does not go to the heart of the operation or change its substance or change the kind of product or result obtained. Under the law this does not relieve such user of the charge of infringement. There is no real dispute on the facts, and they are the sole determining test of infringement. The facts demonstrate infringement from January 7, 1917, to the time of trial.

The fuel oil and the kerosene which, when employed in minute proportions in conjunction with minute proportions of a mineral-froth-forming oil and with a soluble frothing agent of the 1910 patent, sometimes benefit the result by preventing the dropping of some larger mineral particles out of the froth and by steadying and stabilizing the froth, may in the uselessly excessive quantities employed by appellant effect that same benefit, or it may not. The weight of evidence is that it does not. But even if it does, that benefit does not change the process in its substance and does not change the results obtained in kind.

It is worse than foolish to say, as appellant's brief says, that the result is different because the appellant's profits are being reduced at the rate of \$1,000,000 per year, with the intimation that that was the sort of result the Supreme Court referred to in its decision.

This is foolish because there was no ore concentration process known to the prior art by which any profit at all could be made except water concentration (and that did not involve oil) and the Elmore Bulk Oil process (which required ton for ton of oil and ore and which even defendant's witnesses all differentiate), and perhaps Cattermole (which recovered the metal and could only recover the metal by sinking it). The Supreme Court could not by any possibility have had any increase of commercial profits in mind as the "results obtained" to which it says the patent must be confined. And the argument is worse than foolish in that it discloses the emptiness of appellant's armory of argument to support its contention of non-infringement.

It is also a simple begging of the whole question to say that the appellant's froth concentrate has contained more oil since January 7, 1917, than it did before, because the very question is whether the presence of the alien oil in the froth concentrate that gets there from the operation makes that froth concentrate any different in kind, or the operation by which it was produced any different in kind, and the evidence on both sides is that it does not.

It is idle too to argue that appellant's froth has more oil in it since January 7, 1917, than before, and that that was the distinction the Supreme Court made between appellees' froth and the prior art; for that was not the distinction the Supreme Court made. The Supreme Court did not find in the prior art a froth the air bubbles of which carried a

large proportion of the metalliferous content of the ore and in addition a *large quantity of oil* from which it differentiated appellees' froth merely by the *lesser quantity of oil* in it. That was emphatically not the situation. The Supreme Court found a broad novelty in appellees' froth which it defined, as we elsewhere point out, and appellant's froth since January 7, 1917, is as much that novel froth in kind as was appellant's froth prior to that date.

Attempted Justification by the Prior Art.

Where a defendant seeks by the prior art to justify his procedure against a charge of infringement it is usual for him to point out just what process of the prior art it is that he is using. Appellant's brief, however, will be searched in vain for any such identification of its 1917 procedure with any process of the prior art; and the reason for this is not far to seek.

Appellant's process is not the EVERSON process. That process is merely a water concentration or shaking table process reversed, that is to say, one in which the positions of the gangue and of the mineral are reversed in the water. In Everson it is the mineral matter instead of the gangue that floats, that is, flows, in suspension in the upper strata of the water and goes over the top of the riffles (Everson patent, p. 2, 1, 105-111. Vol. 4, p. 2058). This is brought about by the Everson treatment of the ore with seventeen per cent. of a petroleum oil which attaches itself to the mineral particles and by its lifting force or buoyancy makes

them of less specific gravity than the gangue. There is no froth in Everson. There is no mere reversed water concentration in appellant's procedure.

It is not KIRBY. Kirby's oil was a mixture of kerosene and bitumen (petroleum products), and he used five hundred pounds to fifteen hundred pounds per ton of ore. His idea was by agitation (what he called violent agitation, but which was not violent from our modern standpoint) to break up the petroleum oil mixture into small globules and bring about contact of such oil globules with the mineral particles (Kirby patent, p. 1, lines 73 to 78), and to lift the mineral particles chiefly by the buoyancy of the oil but assisted to some degree by injected air or gas, and to carry the mineral particles in an oil layer on top of the water and at the lower surface of the oil layer where it contacts with the water (p. 3, line 55). The lifting force was not chiefly by air, but was chiefly by oil, and there was no air froth carrying metal particles in the films of its bubbles, but a floating body of oil carrying those particles.

It is not FROMENT. The Froment process depended essentially upon the buoyancy of oil for its lifting force, assisted by a chemically evolved gas, which produced an oil and mineral magma or paste, carrying the mineral particles in the oil and entrapping some gas bubbles in the pasty floating mass.

It is not the process of the CALIFORNIA JOURNAL. That was again an instance of an oil-lift of the mineral particles assisted by air, and the holding of the

mineral particles in an oil and mineral paste or magma on the surface.

Everson, Kirby, Froment and the California Journal all employed petroleum oils and petroleum oils alone, and these oils, it has been demonstrated in the case at bar, when used alone and without any true froth-forming oil or any soluble frothing agent intermixed with them, cannot form a mineral-bearing froth or achieve the process in suit.

The appellant has put forward in another form the contention of justification by the prior art.

It begins by asserting that the novelty and virtue of the process in suit is the economy in the amount of oil used and the large values recovered as the result of utilizing such small quantity of oil. It then proceeds to assert that it uses larger quantities of oil with less values in the recovery. It derives from these two assertions the final assertion that therefore it is not practicing the process of the patent in suit. In other words it says "We are wasting oil and wasting values and therefore we are not infringing" This is certainly a most remarkable argument. If accepted it would result in establishing as a principle of patent law that one is at liberty to use the patented process of another provided one does it badly.

The whole argument, however, is unsupported in reason or in fact.

The novelty and virtue of the invention of the process in suit resides in the mineral-froth-forming

characteristic of the oil present and the result achieved thereby. It is a happy incident of the invention that this characteristic develops the most when the quantity of the oil is the least.

It is also the fact that where its work is not hindered by the presence of non-frothing oils the grade and recovery are better.

Appellant recognizes these facts and honestly confesses them, but derives therefrom an utterly unwarranted conclusion. Appellant achieves the result which characterizes the process in suit and achieves it by producing a mineral-bearing froth by the use of mineral-froth-producing oil in a fraction of one per cent. on the ore. It adds other and non-frothing oils for the purpose of claiming an aggregate of oil greater than one per cent., and in so doing has lessened the grade and recovery besides adding to the cost.

Appellant omits no feature of the invention, and simply adds a feature which makes the process, not different but, merely less efficient.

Appellant's purpose was to get the results obtained by the process of the patent by the apparent use of an amount of oil that would take it outside the patent. But it is only the "oil of the patent" that gets the result and neither arithmetic nor law permits an infringer to add the "oil of the patent" to oil not of the patent and state the result in terms of the "oil of the patent".

Appellant's brief seems to imply that it is now seeking to claim that the results of its procedure are different from the results obtained by the process of

the patent in suit, that is, are different in character. Appellant's whole effort throughout the case below was to establish the exact contrary of this. A mass of evidence was produced to demonstrate that when appellant used its mixture the results were identical with the results obtained by employing exactly the process of the patent in suit. The only difference is in degree, not in kind or character. It is the same result, only poorer. It is achieved in the same way by the same agency and is made poorer merely because of the addition of the unnecessary non-frothing oils added for argumentative, not business purposes. The unnecessary addition reflects the legal exigency rather than any metallurgical astuteness. It is in no sense a reversion to the prior art.

The prior art fails entirely to disclose or to justify the process that appellant used from January 7, 1917, to the time of trial either specifically or generally.

Comparison of Appellant's Process with Appellees'.

The simple and ordinary and rational method of determining a question of infringement is to *directly* compare the process of the patent in its substance and essence with the process in its substance and essence as to which the question arises; and we see no reason why that method should not be applied here.

What is the substance and essence of the process in suit as defined by the Supreme Court in the Hyde case?

The *essence of the result* is (page 3 and again page 4 of pamphlet decision) a peculiarly persistent froth

composed of air bubbles modified by the presence of only a trace of oil in them and which air bubbles carry or hold in mechanical suspension a very high percentage of the mineral content of the ore.

The *essence of the operation* (as set out on page 5 and contrasted with prior art operations and as quoted with approval from the House of Lords decision on page 6) is the lifting of the mineral particles in the pulp (which lifting separates them from the other substances of it) chiefly by "the buoyancy of the air bubbles" which air bubbles have previously attached themselves to, or have attached to themselves, the oil-coated mineral particles.

The *essence of the means* to that end is the multitude of modified air cells that are introduced or form upon agitation in an ore pulp modified to that end by the presence of an oil or oily liquid having a preferential affinity for the mineral matter and of such a character and in such quantity as to act as such a modifying, that is to say, a mineral-froth-forming, agent.

Tested by these essentials it is manifest that appellant's process since January 7, 1917, has utilized the essence of these means, and developed the essence of this operation, and obtained the essence of this result. It is therefore an infringement.

**APPELLANT'S ARGUMENT THAT IT DOES NOT INFRINGE
BECAUSE OF THE RESULTS IT OBTAINS.**

Although appellant does not formulate this argument clearly and state it specifically it is quite apparent from intimations in its brief that it intends to urge it.

The argument, if we understand it, is in brief that appellees heretofore when confronted with the prior art have distinguished the process in suit by the froth which it produces, as containing less oil and more mineral than prior art froths, whereas, when arguing infringement, appellees abandon that distinction and assert infringement notwithstanding appellant's froth contains more oil and less mineral.

Such plausibility as this argument has, springs from its very vagueness and generality. The moment the factors it involves are accurately thought out and appellees' contentions in the Hyde case are accurately understood and applied, the argument disappears into thin air.

The prior art factor with which it starts is the wholly spurious showing made in that regard by Dr. Byrnes in that case and by experiments at the hearings. Oil froths were produced the like of which never existed before. Appellant's present froth is not like any one of these. Appellees said of them everywhere and always, in evidence and argument, that they were not prior art and were merely useless legerdemain of the laboratory and that if they got appellees' results it must have been by appellees' process.

As to the real prior art appellees said everywhere and always, in evidence and in argument, that a new result had been obtained—an air froth as contradistinguished from oil lakes and oil floats and oil magmas—and by a new mode of operation—an air flotation as contradistinguished from an oil flotation. Appellees said that the new result was an air-froth carrying a large

proportion of the mineral of the ore, and distinguished it from the products of prior processes not as one air-froth from another air-froth containing more oil and less mineral, but as the first mineral-carrying air-froth of any kind ever produced. Appellees pointed out that all prior oil concentration processes were failures except Elmore and Cattermole, and that the products of these processes that failed, contained more oil than appellees' product, but only incidentally, appellees' contention being always that the product of the process of the patent in suit, the results obtained by it, were wholly new in kind and not merely new in degree as appellant's argument under consideration assumes.

And the Supreme Court has so held.

Appellant's process today obtains the same results in kind as appellees' process, an air-froth carrying a large proportion of the mineral of the ore, and this mineral-carrying air-froth is obtained by air flotation following the agitation of the pulp which has been modified by the presence of the fraction of one per cent. of an oil of the patent, all as described in the patent and as set out by the Supreme Court. It is not true that the appellant is practicing any process of the prior art. It is not true that the appellant is producing by its operations the results obtained by any process of the prior art. The appellant in the court below not only did not intimate or pretend that it was not obtaining the same result in kind as appellees' process obtains, but it produced a volume of evidence followed by a strenuous argument that there was no difference scientifically or technically in the action or result.

The argument of the appellant here on the one hand and the proofs and argument of the appellant as defendant below on the other hand, not only fail to support each other but the fact is that the latter are absolutely repugnant to and destructive of the former.

It is unnecessary for us to make specific reference to detailed testimony when it is all so clearly summed up by defendant's counsel in the court below, which, although quoted heretofore will be here quoted again:

“Now I maintain that it has been satisfactorily proven by our witnesses, Professors Bancroft, Sadtler, Taggart and Beach, that there is no difference between the action of plus one per cent. of oil and minus one per cent. of oil in any respect that science can develop, and technically there is no difference. Our mill operations as set forth in these tabulated statements which we have introduced and in testimony of our witnesses show that there is no difference from a technical and commercial viewpoint. It is a case in which practice and theory are in absolute agreement” (Oral Arguments below of Defendant, p. 34).

And all of appellees' testimony was to the effect that appellant's results were the same as appellees'.

And none of appellees' arguments in the Hyde case are inconsistent with that proposition.

And when it is realized, as it must be under the proofs, that the appellant obtains as the result of its procedure an air-froth carrying a large proportion of the mineral content of the ore and obtains that result by utilizing the “oil of the patent” in an amount less than one per cent. on the ore, it is too obvious to require further elaboration that it is practicing the process of the patent in suit, securing the results obtained by that process and is infringing.

THE REVOLUTION THE INVENTION HAS WROUGHT, THE MYSTERY OF ITS OPERATION, ITS BROAD AND PIONEER CHARACTER, ALL JUSTIFY AND REQUIRE THE MOST LIBERAL CONSTRUCTION OF THE PATENT KNOWN TO THE LAW.

The holding of infringement does not require any liberality of construction of the patent, even the least, but if it did, the court should not hesitate to treat the patent with the utmost liberality.

At the time of the taking of the testimony in the Hyde case, more than nine million dollars in values had been taken out by the process in Australia, with more than four million dollars of profits, and the process had been introduced into commercial use in Finland, Sweden, Wales, Chile and Cuba, but its use in the United States had only just begun with the operations there charged as the infringement.

Even on that relatively meagre showing the Supreme Court found the use extensive and the discovery important (p. 6).

Since that time, however, the extension of the use both in this country and abroad, has been simply marvelous.

Appellees had thirty-seven licensees in the United States on May 7, 1917 (Vol. 7, p. 4028), who had treated according to the process upwards of thirteen million tons of ore (Vol. 9, p. 5334).

One of the largest of these licensees is the Anaconda Copper Mining Company, which tested the process for a year and installed it in 1915, scrapping, in that

operation, a going and modern water concentration plant of the value of upwards of eight hundred and fifty thousand dollars (Vol. 8, p. 4298, Q. 24 to 26). The flotation installation was completed about January, 1916. It has a total capacity of nineteen thousand tons a day in the copper concentrator, and two thousand tons a day in the zinc concentrator, and during 1916 3,800,750 tons of freshly mined ore were treated in it. A slime pond, the reject of former water concentration processes, is being treated by flotation at the rate of one thousand tons a day. A reasonable estimate of the values that will be recovered from that slime pond, over and above cost of recovery, is four million dollars (Vol. 8, p. 4308, Q. 65 to 68). The company had employed water concentration from 1902 to the end of 1915, and ran the tailings to waste in the valley. A competent witness giving figures as to the actual recovery of copper year by year from the tonnage so treated, estimated what would have been recovered from that tonnage year by year if flotation had been then existent and available with an efficiency equal to the 1916 record of the company, considering the cost of operation and the prices of copper during those years. The increased yield of copper from the same ore over and above what was actually obtained by water concentration and over and above the total cost of treatment by flotation, would have had a value of upwards of thirty-eight million dollars (Vol. 8, p. 4305, Q. 61 to 64).

The Inspiration Consolidated Copper Company, another licensee, is one of the great porphyry copper com-

panies. Its flotation plant has a total capacity of eighteen thousand tons of ore a day, or about 6,500,000 tons a year, and is being enlarged (Vol. 7, p. 4049, Q. 50 to 54).

Mr. Atwater testifies to the purchase from appellant of its Basin dump, the reject or tailings from appellant's former water concentration processes employed before its infringement began. This dump consisting of a residue of about fifty to sixty thousand tons, has since been reground and retreated by flotation. Mr. Atwater estimates from the results of that retreatment that appellant lost by not having concentrated it by flotation one million dollars of the zinc and lead and silver values in the three hundred thousand tons of ore, the tailings of which went to make up that dump.

Appellant's Exhibit 158 (Record, p. 5184) shows that during 1913, 1914, 1915 and 1916 it treated by flotation upwards of 1,500,000 tons of ore by the process in suit.

Appellant's evidence detailing the operations of the Utah Copper Company, the Ray Consolidated Copper Company and the Chino Copper Company shows the enormous extent of the use these companies have made of the invention. The suit against the Miami Copper Company has adjudged the use of the invention by another of the great porphyry companies.

It would be almost impossible to overestimate the obligation of society and mankind to the inventors of the process here in issue. It has created untold wealth in that it has made recoverable what was be-

fore not recoverable—has made profitably workable mines that before were not profitably workable—has recovered some of the wastage of the past and will prevent such wastage in the future. The invention has as truly added to the wealth of the world as if new mines of fabulous value had been discovered and had been opened up to the use and benefit of mankind for all time.

As the Circuit Court of Appeals for the Third Circuit said in *McClave-Brooks Co. v. Treadwell Co.*, 220 Fed. 144, 145:

“It is clear, therefore, that any discovery which substantially contributes toward the utilization of such supposedly worthless dumpings challenges the careful attention of those charged with the administration of the patent laws.”

See, also, to the same effect, the same court in *Moore Filter Co. v. Tonopah-Belmont Development Co.*, 201 Fed. 532.

A Pioneer Invention.

A pioneer or primary invention is one that strikes out in a new line of operation, achieves a new result, and either founds a new art or revolutionizes an old one.

All three things are true of the invention in suit.

The Supreme Court has so held, and the new evidence here showing the extent of the revolution that has since been wrought in the art makes this case almost unique in the annals of pioneer inventions.

The Supreme Court decision makes luminously clear, that the patentees struck out in a new line and achieved a new result.

Thus the Supreme Court says or quotes with approval as follows respecting the invention:

“it produces a result never obtained before,”

“the resulting froth concentrate so different from the product of other processes,”

“it differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrate,”

“they are engaged upon a new method of separation,”

“the lifting force is found not in the natural buoyancy of the mass of added oil but in the buoyancy of air bubbles,”

“the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but * * * this force is to be found chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before,”

“a froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which was contained in the mass of crushed ore subjected to treatment,”

“a froth * * * of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated,”

“they discovered the final step which converted experiment into solution, ‘turned failure into success,’”

“a patentable discovery as new and original as it has proved useful and economical.”

The new evidence in the case at bar confirms and emphasizes these holdings of fact in a truly remarkable way.

1. There is here the new evidence as to the discovery that by the substitution of the soluble frothing agent of plaintiff's 1910 patent (No. 962,678) for the oil of the patent in suit, without other change, either of ingredients or of manipulation, the air-bubble phenomenon is evoked and the air-lift operation proceeds and the air-froth result is obtained. This new fact has compelled a re-examination of the fundamental causes of the phenomena underlying the process of the patent in suit and a clarifying of the vision of practical experts and scientific men alike as to the true explanation of the action. The soluble frothing agent which goes into solution in the water can have no preferential affinity for metal, so preferential affinity cannot be essential to the operation. The phenomenon that is common to the oil of the patent in suit and the soluble frothing agent of the 1910 patent is the phenomenon of the modified air-bubble formation and of the avidity with which the modified air bubbles seek out the mineral particles in the pulp and lift them to and through the surface of the pulp, and the persistency of those modified air-bubbles in the mineral-holding air-froth so formed. This clarifying of the

explanation of the phenomena involved is well illustrated in the theory on the subject presented to the Court in this case by the three scientific gentlemen produced as witnesses for the appellant, their theory involving the action of *adsorption layers of microscopic thinness in the bubble films*. This new evidence brings into new prominence the statement of the patent in suit, page 1, line 91, as to the mineral rising to the surface in the form of a "froth or scum which has derived its power of flotation mainly from the inclusion of air-bubbles introduced into the mass by the agitation." It also constitutes a remarkable confirmation, as we have said, of the holding of the House of Lords and of the Supreme Court that in the patent in suit the action is chiefly due to the multitude of air-bubbles and to their buoyancy and that the separation proceeds by an air-lift as contradistinguished from an oil-lift and ends in a new technical result, namely, an air-froth holding a large portion of the mineral content of the ore in mechanical suspension.

2. The further new evidence in the case at bar to the effect that there are many oils that will not with any ordinary ores effectuate this operation or produce this result, and that these alien oils can be added in considerable quantity or bulk without destroying the process provided there is present a sufficient quantity of a soluble frothing agent in addition to a suitable small quantity of mineral-froth-producing oil,—this new evidence confirms the conclusion that the oil of the patent in suit is not operative because oil as oil has a prefer-

ential affinity for mineral matter over gangue, but that it is operative because of its mineral-froth-forming capacity.

3. The new testimony in the case at bar as to the growth and extension of the commercial use of the process of the patent in suit in the last three or four years, confirms the holding of the Supreme Court that the invention not only converted experiment into solution, turned failure into success, but constituted a patentable discovery "as new and original as it has proved useful and economical," and that "it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation, it promptly came into extensive use for the concentration of ores * * * and that, because of its economy and simplicity, it has largely replaced all earlier processes." Counsel for defendant below phrased this so well that we adopt his statement (Oral Arguments for Defendant, p. 31): "If there is something new in this patent, something that we can absolutely prove to be new, then I will admit that the acceptance of that new thing by the public generally would be very persuasive that that new thing was important." He added "But that is not the case here", thereby quarrelling with the decision of the Supreme Court, which quarrel the appellant has now abandoned. The new evidence on this subject stamps the invention of the patent in suit as the beginning of an art, namely, *the art of ore concentration by air-bubble selection and lift and air-froth*

separation, and as of such stupendous practical importance to commerce and industry and society as to make it almost unique in the history of invention, and to rank with the inventions of Morse, Howe, Bell and Westinghouse. Many of the inventions that have been lauded by the courts as important and of a pioneer character seem almost trivial. The invention here in suit has been epoch-making in metallurgy.

It is familiar law that on a question of infringement the liberality with which a patent is treated is in a measure dependent upon the inventor's deserts and upon the obligations of society, and that in the case of an invention that has been of stupendous practical importance to commerce and industry and society the greatest liberality is exercised in construing the patent and its claims and in applying the doctrine of equivalents.

Cases where a broad and liberal construction was given to a patent because the invention had revolutionized an art and in which the facts were parallel to the case at bar are:

The Telephone Cases, 126 U. S. 1;

Consolidated Safety Co. v. Crosby Co., 113 U. S. 157;

Tilghman v. Proctor, 102 U. S. 707;

Winans v. Denmead, 15 How. 330;

Morley Sewing Mach. Co. v. Lancaster, 29 U. S. 263;

Hobbs v. Beach, 180 U. S. 383.

In *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U. S. 405, the court said:

“The lower courts did not designate the invention as either primary or secondary. They did, however, as we shall presently see, decide that it was one of high rank and entitled to a broad range of equivalents * * * The right view is expressed in *Miller v. Eagle Mfg. Co.*, 151 U. S. 186, 207, as follows: ‘The range of equivalents depends upon the extent and nature of the invention. If the invention is broad or primary in its character, the range of equivalents will be correspondingly broad under the liberal construction which the courts give to such inventions.’ And this was what was decided in *Kokomo Fence Mach. Co. v. Kitselman*, *Cimiotti Unhairing Co. v. American Fur Ref. Co.*, and *Computing Scale Co. v. Automatic Scale Co.*, 204 U. S. 609. It is from the second of these cases, as we have seen, that the citation is made which petitioner contends the point of law upon infringement depends is formulated; but it was said in that case: ‘It is well settled that a greater degree of liberality and a wider ranger of equivalents are permitted where the patent is of a pioneer character than when the invention is simply an improvement, may be the last and successful step, in an art theretofore partially developed by other inventors in the same field.’

It is manifest, therefore, that it was not meant to decide that only pioneer patents are entitled to invoke the doctrine of equivalents, but that it was decided that the range of equivalents depends upon and varies with the degree of invention. See *Ives v. Hamilton*, 92 U. S. 426; *Hoyt v. Horne*, 145 U. S. 302; *Deering v. Winona Harvester Works*, 155 U. S. 286; Walker, Patents, sec. 362; Robinson, Patents, sec. 258.”

In *Schmertz Wire Glass Co. v. Western Glass Co.*, 178 Fed. 973, the court said:

“When an entirely new process is invented and patented, revolutionizing the art, the claims will be given a broad construction, as in the case of a foundation patent.” (Citing Supreme Court authorities.)

As Judge Acheson said in *U. S. Mitis v. Carnegie Steel Co.*, 89 Fed. 343, affirmed on the opinion below, 90 Fed. 829:

“The evidence is quite convincing that his invention was of a primary character and therefore the patent should be liberally construed so as to secure to the patentee and his assignees the fruits of the actual invention in full measure, if this can be done consistently under the terms of the specification and claim.”

This was later illustrated in *Carnegie Steel Co. v. Cambria Iron Co.*, 185 U. S. 403.

Throughout all of these cases and many others runs the thought that the reward of the inventor should in some degree and to some extent be commensurate with the value and importance of his contribution to the resources of mankind.*

Validity.

The second question to be decided is:

“HAS THE APPELLANT PROVED THE EXISTENCE OF ANY STATE OF THE PRIOR ART SUBSTANTIALLY DIFFERENT FROM THAT WHICH WAS PASSED UPON BY THE SUPREME COURT IN THE HYDE CASE?”

The answer is that it has not. The contrary answer (if a contrary answer be intended) is not urged in appellant's brief (pp. 63-71) with insistence or any indication of conviction.

* For a fuller discussion of authorities on infringement see Supp. Br. p. 144.

The California Journal of Technology is the only document of the prior art that was not before the Supreme Court, but appellant's brief does not even mention it. It appeared for the first time in the Miami case and was dismissed by Judge Bradford as discussing laboratory tests that far from suggesting the possibility of the invention pointed to an opposite conclusion. It was dismissed by the Circuit Court of Appeals in that case with a mere mention, and was dismissed by the court below in this case as detailing a "suggestive but rather misleading and abandoned experiment."

The new evidence mentioned in appellant's brief at pages 63 to 71 does not relate to the prior art. The mill operations there referred to with quantities of oil above 1% did not any one of them separately or altogether reproduce any process of the prior art. Those procedures only employed what appellant's brief repeatedly terms "prior art quantities of oil" (an ingeniously misleading expression) in subsequent art procedures. As matter of fact every such mill operation without exception included a soluble frothing agent in the mixture employed, thereby utilizing an invention that was not made until 1909 or thereabouts, and every such operation employed a fierceness and violence of agitation that were undreamed of in the prior art, and every such operation employed a Janney machine, which gives a peculiar kind, as well as an extreme degree, of agitation, and which was not devised until 1913 or thereabouts. Similarly all of those operations employed as the main ingredient of the oil mixture certain petroleum products that Dosenbach and Janney after two or three

years of investigation (beginning in 1913 or 1914), during which thousands of oils and oil mixtures were tested, had discovered to be inactive in this process and yet not destructive of it. Such operations cannot possibly cast any light on the prior art.

The new evidence as to the enormously extending use and utility of the process since the testimony in the Hyde case was taken, the new evidence as to the subsequent surprising discovery that a material which went completely into solution in the water and remained there and could not and did not coat the mineral particles yet caused a similar air selection and separation and lift and produced a similar mineral-carrying air-froth, and the new evidence of scientific men as to the philosophy of the process, all tend most strongly to confirm and emphasize the Supreme Court's conclusion of fact that a new operation and result was in fact obtained, and to confirm and emphasize the Supreme Court's discriminating definition of that operation and result as an air separation and lift and a modified air-bubble holding or carrying of the mineral matter in a froth that persisted long enough for convenient separation.

The argument made before the Supreme Court by counsel for appellees here, and which is quoted on pages 64 to 68 of appellant's brief, was an argument addressed in part to the use of a mineral-froth-forming oil of the patent in suit in proportions greater than 1% on the ore (in procedures which appellees' counsel contended and their witnesses testified *did not represent*

the prior art) and that argument is just as sound on the record in the case at bar as it was on the record in the Hyde case, for in this respect there is no testimony in the case at bar additional to that in the Hyde case. That testimony shows the failure that ensued when Mr. Higgins attempted to employ cottonseed oil (a mineral-froth-forming oil of the patent) in an amount equal to 3.6% on the ore in a miniature plant, and the failure that ensued when Mr. Chapman put through the same operation in a full-sized plant with 1.8% of oleic acid. Appellant in its brief asserts (p. 27) that these operations were successful metallurgically and bases his whole argument upon that assertion. As the assertion is absolutely unjustified by the evidence, the argument based upon it utterly falls. Both operations were abject failures and entirely justified what was said of them in argument by counsel for plaintiffs in the Hyde case. The proper deduction from the results of these operations establishes the soundness of appellees' position that, so far as the evidence showed in the Hyde case and shows here, the use of more than a fraction of one per cent. of an "oil of the patent" has not succeeded in the mill.

The evidence in the case at bar does not in the slightest degree disprove what these experiments established, for not a single one of the mill operations testified to or proved in the case at bar with quantities of total oil at or above 1% on the ore, as we have already said, employed more than a fraction of 1% of mineral-froth-forming oil. The oils that were in fact employed in quantities greater than a fraction of 1% on the ore

were alien oils that would not alone and of themselves and without the presence of a frothing oil of the patent in suit or a soluble frothing agent of the 1910 patent, in any proportion or quantity, large or small, effectuate the operation or bring about the result of the patent in suit. This new evidence therefore but confirms the evidence on which the Supreme Court decision was based.

THE HYDE SUIT EVIDENCE REFERRED TO IN APPELLANT'S BRIEFS AND THE ARGUMENTS OF PLAINTIFFS' COUNSEL IN THE HYDE SUIT FRAGMENTARILY QUOTED IN APPELLANT'S BRIEFS, DO NOT RELATE TO PRIOR ART OR "PRIOR ART FROTHS" OR WHAT WAS ACTUALLY DISCLOSED OR DONE IN THE PRIOR ART WITH "PRIOR ART QUANTITIES OF OIL".

The evidence above referred to in the Hyde case, like appellant's evidence of mill operations in the case at bar, did not relate to the prior art. It related to defendant's misrepresentations of the prior art. Defendant's expert, Dr. Byrnes, testified that he had performed *ex parte* a series of five experiments in which he said he "operated the process of the Froment British patent" (Vol. 4, p. 1528). These are the experiments upon which all of this evidence was founded. Plaintiff's experts vehemently denied that these were operations of the process disclosed by Froment.

For example Dr. Liebmann quoted this statement of Dr. Byrnes (Vol. 3, p. 658), and then first criticized the experiments because they were carried out in a machine known as the slide machine (which was not invented until 1909, four years after the invention in suit) and says that a true test of these experiments would be to

repeat them in a test tube such as the Froment patent discloses, although he says that this repetition of the experiments is not necessary to demonstrate that Dr. Byrnes' experiments "have nothing to do with the Froment patent" (p. 659).

He then translated Dr. Byrnes' alleged five Froment experiments back to test tube proportions, and in each instance he failed to develop the Froment operation or to produce the Froment result (pp. 659-664). He calls attention to the fundamental idea on which Froment based his invention, the generation of a gas in the pulp by the action of sulphuric acid on limestone (p. 665), and the facts that Dr. Byrnes added no limestone and that in the ore which he used there was no material to take its place and that the amount of sulphuric acid was wholly insufficient to develop any action by it and that if it had acted the gas generated by it would have been four times over dissolved in the pulp and therefore utterly useless (pp. 665-668). As to the first experiment he says:

"I cannot conceive the reasons which induced Dr. Byrnes to describe this experiment as an experiment conducted according to the Froment patent. It differs in principle, in proportions and in the mode of carrying out absolutely from anything which is revealed in the Froment patent. As a matter of fact, it is nothing but the production of the agitation froth carried out according to the process of the patent in suit" etc.

This first experiment, employing 1.1 lbs. of cottonseed oil per ton of ore (.05%), is not referred to in appellant's brief.

In the second experiment Dr. Byrnes says he employed 3.6% of cottonseed oil. Dr. Liebmann says:

“It can never be considered a Froment experiment” (p. 669).

Dr. Liebmann also says:

“The oil quantities are not Froment’s quantities; the acid quantities are utterly different from Froment’s quantities, and the principle involved is utterly different from Froment’s principle” (p. 670).

He also says:

“The same remarks and criticisms apply equally to the other three experiments” (p. 670).

Experiment 4 was said to be with 3.6% of oleic acid. Dr. Byrnes admits that it was a failure, and it therefore received no further attention.

In further discussing these experiments Dr. Liebmann says:

“Dr. Byrnes has not produced a single experiment which can be called an experiment truly carried out according to the Froment patent. His test-tube experiments have nothing whatever to do with it. His experiments on pages 165 to 166 [the slide machine experiments above considered] have nothing whatever to do with it. I have not repeated them. I have not considered it wise to chase these hares which have been pushed into our road to detract attention from the real issue of this case, to complicate its simple issues and to confuse them” (p. 677).

Dr. Liebmann here succinctly summarized the methods of appellant’s present argument.

Dr. Liebmann further said of these experiments in cross-examination:

“The assumption of counsel that I have considered these experiments as Froment experiments is not correct, and I regret that my description of them and the reasons which induced me to make such experiments have been such as to mislead counsel. To avoid a further misunderstanding, I will now speak out in such language that such a misunderstanding cannot occur again. I consider the experiments of Dr. Byrnes, of which these test-tube tests are the translation into the quantities of the test-tube example, as utterly absurd, and not at all representing anything which Froment described or which could arise out of the Froment description. * * * I repeat that the experiments introduced by Dr. Byrnes have nothing to do with the Froment patent” (pp. 793, 794, XQ113).

And finally Dr. Liebmann said of these four alleged experiments of Dr. Byrnes, No. 2, employing 3.6% of cottonseed oil, No. 3, employing 3.6% of olive oil, No. 4, employing 3.6% of oleic acid (and a failure) and No. 5 employing 1.8% of a very pure oleic acid:

“Dr. Byrnes says he has produced a froth with a large quantity of oil. If it is produced, it is not produced by the Froment process, *but by the process of the patent in suit*” (p. 828).

The testimony above quoted follows immediately after the quotation in appellant’s brief (p. 28) from the same page, and since it negatives the entire argument as to what appellant’s brief says are the “standards which the plaintiffs applied to distinguish the froth of the patent from prior art froths” (appellant’s brief, p. 29), its suppression seems to be misleading.

Further it directly contradicts what appellant’s brief says as to Dr. Liebmann’s testimony (p. 27), as follows:

“The view advanced by plaintiff’s expert, Dr. Liebmann, which was evidently adopted by the Supreme Court, is that the froth produced by the use of excess of oil above the minute and economical proportions set forth in the patent is not *the* froth of the patent in suit.”

The fact is that Dr. Liebmann testified that if Dr. Byrnes produced a froth in these experiments it was produced “by the process in suit.” We believe that the Supreme Court also adopted this view.

Although Dr. Liebmann considered these alleged experiments so wholly irrelevant to the prior art which he was explaining to the court that he did not repeat them, it was deemed advisable for the information of the court to test operations of this character in other than laboratory manipulations, and the tests by Mr. Chapman and by Mr. Higgins referred to at such length in appellant’s brief were these tests. They were not tests of prior art disclosures. They had nothing whatever to do with the Froment patent. They were repetitions on a larger scale of the spurious tests which Dr. Byrnes had falsely represented to be tests repeating the operation of the Froment process. They were all dismal failures.

Based upon them plaintiff’s counsel in the Hyde case contended that defendant’s fictitious case as to the prior art was founded only on laboratory experiments, and that even these laboratory experiments (in no way representing the prior art) when repeated on a practical scale were abject failures. This appears in the more extended quotations appearing in the latter part of appellant’s brief, commencing at page 64, and particularly on pages 67 and 68, and is well summarized in the quoted

extract from Mr. Williams' argument in the Supreme Court appearing at page 68 of appellant's brief, concluding as follows:

"So that we demonstrated the negative of the proposition that the defendant had failed to demonstrate. We demonstrated that these products of the legerdemain of the laboratory, *not prior art at all*, were worthless in the concentration of ores, wholly regardless of the question of the cost of oil or anything else."

It will therefore be seen that the statements in appellant's brief, at page 29, that these were "prior art froths" and that these products of the legerdemain of the laboratory, not prior art at all, were asserted by plaintiffs in the Hyde suit as "the standard which plaintiffs applied to distinguish the froth of the patent from prior art froths" are wholly false.

Appellant's brief follows its misrepresentation of the testimony and arguments above referred to by a statement of the undoubted law that

"that which does not anticipate, if earlier, cannot infringe, if later" (p. 29).

The vice of the argument of the appellant in this respect is that it assumes that the appellees when plaintiffs in the Hyde case considered and discussed these experiments and operations as if they were prior art, whereas the proof on behalf of the plaintiffs and the argument of their counsel denounced these experiments as representing the prior art and asserted that they utterly misrepresented the prior art.

Appellant's brief then says

“to hold that defendant infringes when it uses more than 1% of oil, would be to say that the defendant infringes when it uses prior art quantities of oil” (p. 29).

This expression “*prior art quantities of oil*” is also twice repeated at page 37 of appellant's brief. It is an ingeniously misleading expression. It begs the whole question of the actual disclosures of the prior art. It assumes that the questions of anticipation of the patent in suit and of limitation of the patent in suit by prior art is to be decided as a mere matter of measurement of oil proportions. It overlooks the fundamental fact that patent law is concerned not with *what can be done today* with ingredients disclosed in the prior art, but *what was actually done or disclosed* with reference to these ingredients in the prior art. It also conveniently has in appellant's brief taken the place of a discussion of the actual disclosures of the prior art. No ingenuity of statement, however, can evade the axiomatic rule of patent law that the questions of anticipation and of limitation of a patent are to be decided only on the actual disclosures of the prior art, and this question is not even presented in appellant's brief.

Appellant's brief follows its argument of non-infringement above referred to by a discussion of the opinion of the court below in the case at bar, in which discussion are made substantially the only direct references to the prior art that appear in appellant's brief. It quotes from the opinion below the expression “infinite of bubbles” without its context, and makes it the subject

of attack. The expressions from which these three words are selected are as follows:

“At the same time, though heretofore somewhat ambiguous and obscure, present knowledge warrants the conclusion that the gist of this remarkable and valuable process and the actual discovery and invention are that whereas theretofore in ore concentration air had been used in desultory and fugitive bubbles as a makeshift incident of and supplemental to oil and skin flotation, air can be made to do all the work by creating in water-ore pulp modified by a suitable oily contaminant, *an infinitude of bubbles*. * * * The patent fairly clearly sets out the various ways and means to create this *infinitude of bubbles* and that they do the work” (Vol. 1, p. clxxix).

Appellant then attempts to show by the prior art that the creation of an infinitude of bubbles was old. But appellant must show that it was old to create an infinitude of bubbles in a water-ore pulp modified by a suitable oily contaminant which infinitude of bubbles did the work of floating the mineral particles in a froth, if what appellant shows is to be of any materiality. Anything short of this is wholly irrelevant.

The first reference of appellant is to the Cattermole process. It was a characteristic of that process that the same agitation that would carry on the process in suit and its accompanying unavoidable aeration produced with the Cattermole proportions of oil the Cattermole metal-sinking result; that when these proportions were considerably reduced, without other change, provided the operation started with an oil capable of producing a mineral froth and with the other conditions essential for producing a mineral froth (not all of them

essential to Cattermole) the process of the patent in suit was carried on. That was the history of the discovery. Air cells or submerged air bubbles were produced in the Cattermole process, but they were not in any manner utilized in the Cattermole process. They worked against the process. They were worse than useless. They did not form a froth. But in the process in suit an infinitude of air bubbles is produced and they do the work of floating the mineral particles in a froth.

The other reference to the prior art is to the Froment description. It is a demonstrated fact in the record herein that the agitation of the ingredients described in the Froment description does not produce a froth. With the ingredients of the Froment description no degree of agitation, however intense, would have produced a mineral-carrying froth. The oil was petroleum residuum, a non-frothing oil. Dr. Liebmann so demonstrated in the Hyde case by reproducing the Froment apparatus and carrying on in it the procedure disclosed in the Froment description. The result of the agitation was a thin film of oil on top and the oiled ore at the bottom (Vol. 3, pp. 720, 721). He then repeated the operation in a Gabbett cone mixer, with the same result (pp. 722, 723). He then repeated the operation in the most effective agitating machine known in 1912, to wit, the slide machine, and at a speed of 1600 revolutions per minute, and the result was the same (p. 723). These experiments were not attacked or criticized by any witness for the defendant in the Hyde case or for the appellant in the case at bar. Undoubtedly they produced a great many submerged bubbles, and un-

doubtedly the bubbles did nothing but uselessly form, rise, and explode.

This portion of appellant's brief terminates with further references to "prior art quantities of oil" (p. 37). It again unwarrantedly puts forward this term as if by doing so it was thereby describing some actual process of the prior art. It again insists that plaintiffs' arguments in the Hyde case relative to the experiments of the defendant therein which the plaintiffs denounced as falsely representing the real prior art, are to be taken to be plaintiffs' arguments addressed to the prior art.

The pertinent inquiry of course is, what process was under consideration? The answer is, nothing in the prior art, nothing that existed before the invention, but something which had its origin only in the ingenuity of a defendant in misrepresenting the prior art.

The phrase "prior art quantities of oil" thus repeatedly used by appellant is either meaningless or misleading.

The only oil with which the process of the patent in suit is concerned is mineral-froth-producing oil and the quantity thereof which will obtain the results achieved by the practice of the process in suit.

To use the phrase "prior art quantities of oil" as connoting something in the prior art which prescribes the quantity of that kind of oil for that purpose is misleading—because there is no such thing in the prior art and the Supreme Court has so held.

To use the phrase as merely referring to quantities without regard to process or result is meaningless. The

whole system of weights and measures can be drawn on if you are merely referring to quantities without regard to quality, process or result.

If, when appellant's counsel use the phrase "prior art quantities of oil", they mean to imply that appellant is practicing some process of the prior art and producing by the use of such "prior art quantities of oil" the same result as that obtained by practicing the process of the patent in suit, they are met by the decision of the Supreme Court. It held that under no process of the prior art was there any such result obtained.

If by using the phrase they mean to imply that appellant is practicing some process of the prior art with "prior art quantities of oil" and thereby producing a different result from that obtained by practicing the process of the patent in suit, they are met by the facts in the case. Their own evidence demonstrates the exact contrary of this contention and their counsel so argued (see citations *supra* p. 10).

What appellant is actually doing is using the "oil of the patent" in what appellant admits is the quantity of the patent to obtain the result achieved by the process in suit, and adding thereto an alien oil so as to claim the use of oil in a large aggregate, and terming this aggregate a "prior art quantity of oil" so as to confuse and mislead.

Plaintiff's arguments in the Hyde suit as to oil quantity.—The only arguments presented in behalf of plaintiffs in the Hyde case on the question of oil quantity were those addressed to claim 9. A part of

this argument is the first quotation on page 40 of appellant's brief. Another part of this argument is fragmentarily quoted in the document entitled "Plaintiff's Limitations Regarding the Agitation Froth Patent 835,120" at pages 161, 162, and is completely quoted in appellees' supplemental brief (p. 287). And with this argument of petitioner-complainant before it, the Supreme Court said that the patent must be confined, not to the use of oil "amounting to a fraction of one per cent." on the ore, but to the "results obtained by the use of oil within" such proportions.

Additional evidence that the patent in suit excludes all oils that are not mineral-froth-producing oils as oils of the process described.—A striking difference between the Cattermole process and the process in suit is that the Cattermole process utilized petroleum residuums and kerosene for the purpose of forming sticky coatings on mineral particles and agglomerating these particles into granules, and also, indifferently, utilized the mineral-froth-forming oil, oleic acid, for the same purpose, whereas the process in suit requires, and can only function with, mineral-froth-forming oils, of which oleic acid is typical. This appeared at the time of the discovery. Indeed, if the laboratory researches as to Cattermole had not pointed out an advantage to the Cattermole process in the use of straight oleic acid, the discovery of the process in suit might not have been made. Mr. Higgins' investigations in March, 1905, were stated in Sulman and Picard's Report of March 2, 1905, as separate determinations

with "(a) Oleic acid; (b) Residuum Oils" (Vol. 3, p. 1100). On March 16, 1905, he reported three tests with Balkhany crude oil, 1 cc. (.02%), 2 cc. (.04%) and 5 cc. (.1%), with "very little float", "very little float, small granules" and "less float" (p. 1109). Also with paraffine oil (the English name for kerosene), from .5 cc. (.1%) increased in stages to 1%, the first producing "very little float" the others poor granulation (p. 1110). He sums up as follows:

"A diminution of the percentage of oil when that oil is, either paraffine [kerosene] or Balkhany crude oil, does not cause a similar frothing to the oleic acid, but a diminution in the size of the granules and an increase in the time required for the clean up of the sands" (p. 1111).

In other words Cattermole was impaired but no useful mineral froth was formed by diminution in the percentage of crude petroleum and kerosene below normal Cattermole proportions.

The reference to this subject in the Sulman and Picard Report of May 3, 1905, which is quoted in appellant's brief (p. 47) is less clear and definite, although it also points out that petroleum residuums and mixtures " $R_3 P_1$ and $R_1 P_3$ " (these being mixtures of residuums and paraffine oil or kerosene in the proportions indicated), added as emulsions (and therefore including oelic acid) and paraffine oil (kerosene) alone, give "small proportions of float," and therefore nothing of value, as Mr. Higgins had determined relative to petroleum residuum alone and kerosene alone.

Mr. Chapman explains these symbols (Vol. 2, p. 323, RDQ. 241). The emulsions as used in the Cattermole process contained soap which was decomposed by the

sulphuric acid in the pulp with release of oleic acid as explained in the Cattermole patent (Vol. 4, p. 2138, lines 94-105).

As a result of these investigations, not of course exhaustive, for as the Supreme Court says, "the composition of ores varies infinitely, each one presenting its special problem" (Opinion, p. 7) the patent in suit does not say, as appellant's brief says it does (p. 44) that the Cattermole patent describes "the use of the *same* 'oily substances'" as are to be used in the process in suit, but prescribes "a simple preliminary test" to "determine which oily substance" will do the work with each ore. This is also quoted in appellant's brief (p. 44) following the false statement above referred to, but apparently with no appreciation of its significance. The quotation here in appellant's brief, from the Cattermole patent, of the statement that "mineral oil" can be used (as if thereby to import that description into the patent in suit) is therefore unjustified if not misleading. Mineral oils, i. e., petroleums, are not referred to in the patent in suit and the prescribed test of the patent excludes every oil that is not a mineral-froth-producing oil as an oil of the process disclosed.

Disclaimer.*

The third question to be considered is:

WAS THE ALLEGED DISCLAIMER IN FACT A PROPER DISCLAIMER UNDER THE LAW?

It is a complete answer to appellant's argument in this regard that the disclaimer filed on March 28, 1917,

*For fuller discussion and authorities see Supp. Br., p. 44.

was in fact and in law a disclaimer and a proper disclaimer under Sections 4917 and 4922 of the U. S. Revised Statutes.

The Supreme Court, having reached the conclusion that the patent must be confined in a certain way, and having also reached the conclusion that as to claims 9, 10 and 11 it was not confined in that way, decreed the patent invalid as to those claims. To say that a patent is not confined to a given subject-matter is to say that it is broader than that subject-matter. The Supreme Court condemned claims 9, 10 and 11, not because they were indefinite, but because they were too broad. In this we find that appellant's brief agrees with us (p. 82) where it says:

“The Supreme Court did not condemn these claims on such technical grounds [i. e. “because the term ‘a small quantity’ of oil which they contain is *indefinite*’]. It condemned them because the claims were *too broad*, as clearly appears from the language of the opinion, where it says, etc.”

This presented the precise situation to which the disclaimer statutes are addressed with their beneficent, saving and simple remedy. (See Suppl. Br., p. 48.)

The disclaimer cuts off all the excess by reason of which those claims extended the patent beyond the subject-matter to which the Supreme Court said it must be confined. Thereby it aligned those claims with claims 1, 2, 3, etc., in respect to the Supreme Court decision.

The disclaimer in its recital (Vol. 1, p. cxv) refers to the Supreme Court decision as advising the peti-

tioner that the patent, in so far as concerns claims 9, 10 and 11, covers and includes more than the inventors had a right to claim as new, that such excess had been included therein by mistake and without fraudulent or deceptive intent and without any wilful default or intent to defraud or mislead the public, that the subject-matter not disclaimed is definitely distinguishable from the part disclaimed and is truly and justly the invention of the patentees and is a material and substantial part of the thing patented, and therefore that the petitioner for the purpose of complying with the law and disclaiming those parts of the thing patented which it does not choose to claim or hold by virtue of the patent, disclaims from claims 9, 10 and 11 of the patent:

“Any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore.”

What the decision said the patent must be confined to, that the disclaimer confines claims 9, 10 and 11 to.

To that end the disclaimer employs the very language of the decision.

There may be difference of opinion outside of the Supreme Court itself as to just what its decision means in regard to the confines of the patent, but whatever the decision means that the disclaimer also means. Appellant's criticism of the disclaimer is really a criticism of the decision. Its quarrel is with the decision, not with the disclaimer.

The court below said on this subject:

“The disclaimer to conform to the Supreme Court decision that claims 9, 10 and 11 are invalid was filed 107 days after said decision and after mandate, but before the expiration of time for rehearing. It was timely filed. In substance it fairly conforms to the language of the decision, disclaiming ‘from claims 9, 10 and 11 * * * any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of 1% on the ore’. The parties differ in its interpretation even as they do in respect to the decision. Written words, not oral claims, control. The patent claims included what the patentees were entitled to and more. The decision pointed out the excess. The patentees disclaim the excess. They can safely rely upon the decision and a disclaimer conforming to the language of the decision is sufficient.”

The situation is so simple and obvious that argument to enforce it seems almost a work of supererrogation.

The Supreme Court has told us by its decision that the invention and the patent from the beginning have been as broad as the broad definition it gives to the invention. It tells us also that the patent from the beginning has been broader even than that broad field as to claims 9, 10 and 11. The disclaimer does not broaden the patent one iota in respect to any of its claims thus defined by the Supreme Court, but on the contrary it narrows the patent as to claims 9, 10 and 11 by cutting off that excess by reason of the existence of which the Supreme Court held those claims invalid. So that authorities condemning a disclaimer which attempts to broaden a patent or which attempts to change a claim for one invention into a claim for an-

other invention are wholly inapplicable to the case at bar.

Appellant's brief compares claims 1 and 9 and argues that they are both limited to "the production of the 'froth' described in the specification." But how does appellant's counsel know? The Supreme Court may not have so understood claims 9, 10 and 11. Finding both claims in the patent and seeking for a difference of substance between them, as presumably intended, the Supreme Court may have noted the omission from claims 9, 10 and 11 of the limitation found in claim 1, that it is *the oil-coated mineral matter* that is to form into the froth of claim 1.

The court may have concluded that claims 9, 10 and 11 were broad enough to include some other kind of a froth.

At any rate the owner of the patent was not called upon to construe the Supreme Court decision, but simply to import that decision bodily into the disclaimer, as it has done, and whatever the decision means, that the disclaimer means, and whatever made claims 9, 10 and 11, too broad in the judgment of the Supreme Court that the disclaimer cuts off and removes.

The disclaimer could not safely do any more, and it could not safely do any less.

The true function of a disclaimer is to disclaim an overplus, an excess, what is not the real invention. It is no function of a disclaimer to include within it as a part of the thing disclaimed the real invention or any

part of it. Hence, claims 9, 10 and 11 could not be disclaimed in their entirety.

Appellant's brief says on page 83 that appellees by their disclaimer

“left the over-claim standing, and pretended to limit the condemned claims by inserting a feature which was always in them—not by implication, but in terms.”

The disclaimer inserts nothing either expressly or by implication. It cuts off in words and in fact and in legal effect that excess or over-claim, whatever it was (and we do not have to know precisely what it was. The Supreme Court knew and that is enough) that caused the Supreme Court to find those claims too broad. It is for the Supreme Court to say (if it ever becomes material) just exactly what the excess or over-plus was, but it was not necessary for the disclaimer to say what it was or to do more than it did do, or for the appellees now to define any more than they have done what that excess or overplus was. Whatever it was it has been removed. All that the disclaimer statutes require is that *what is left after disclaimer* be definitely distinguishable and be truly the invention of the patentees, and the Supreme Court has itself authoritatively defined what is left and has held that the patentees truly invented it.

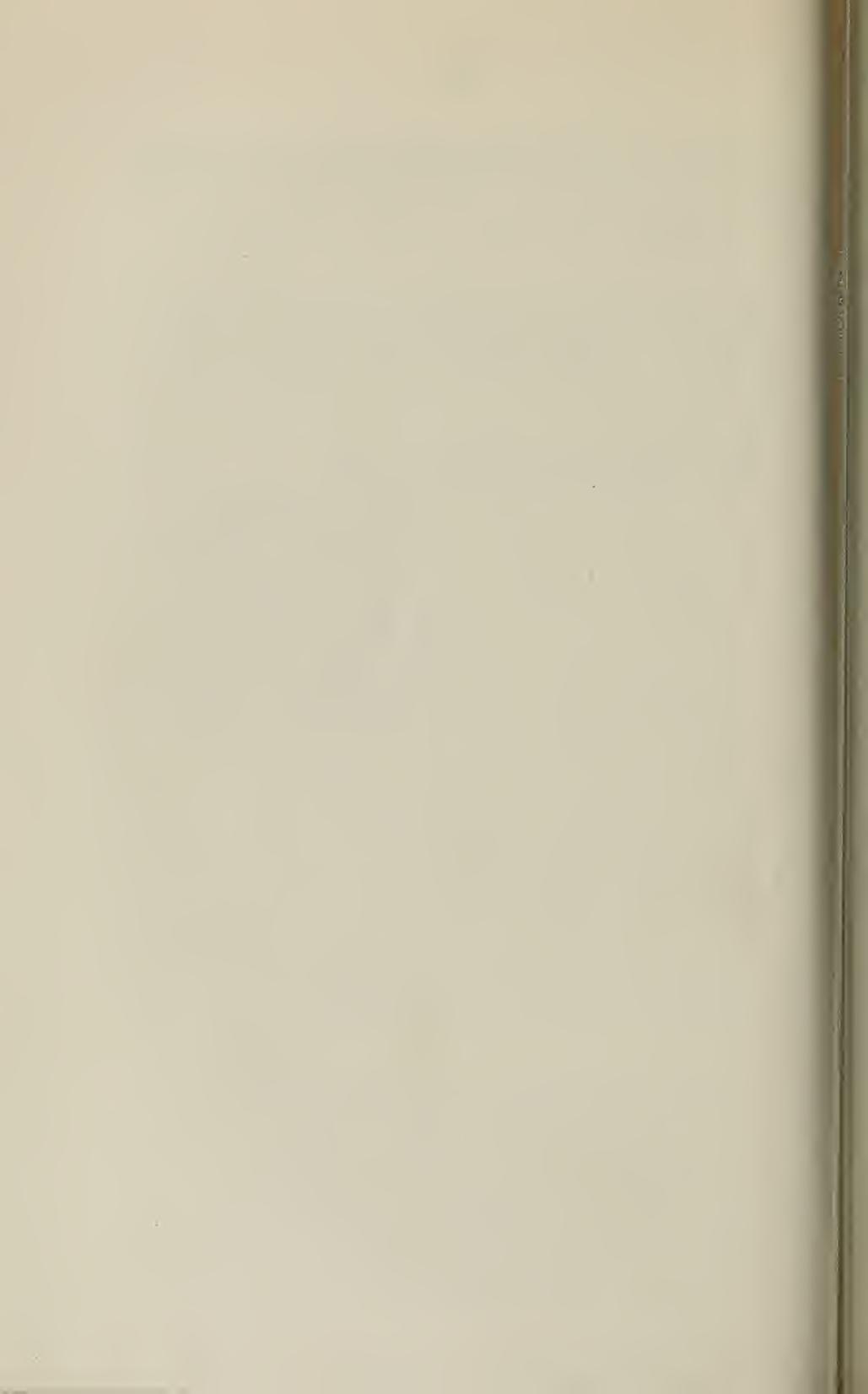
The remedy by disclaimer is inappropriate and the remedy by re-issue is alone appropriate where it is sought to broaden a claim, or to add a claim, or to change the description or to add to it. Where it is sought merely to narrow the scope of a claim, as here, the remedy by disclaimer is appropriate.

We refer to the supplemental brief filed herewith and fully indexed for a fuller discussion of the facts and the law.

In conclusion it is respectfully submitted that the decision of the court below involved no error of fact or of law, and should be affirmed with the costs of this court.

Dated, San Francisco, March 5, 1918.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
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IN THE
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For the Ninth Circuit

BUTTE & SUPERIOR MINING COMPANY,
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vs.

MINERALS SEPARATION, LTD., et al.,
Appellees.

No. 3081

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F. L. MURPHY, CLERK



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Argument of Henry D. Williams, Esq.

If your Honors please, the text of the arguments we make in behalf of the appellees will be the decision of the Supreme Court rendered December 11, 1916, in the suit of *Minerals Separation v. Hyde*. I shall briefly endeavor to show what interpretation the Supreme Court placed upon the patent in suit in the light of actual disclosures of the prior art.

The invention in suit was the pioneer process of air-froth ^{flotation} ~~float~~. The Supreme Court has so said clearly and distinctly. The parts of the decision that have been called to your Honors' attention are not the parts that describe the invention and its relation to the prior art;

just one part of that decision has been called to your attention—that the patentees took the last step, that converted experiment into solution, failure into success.

In the history of patent litigation, many inventors have created new arts, as these inventors did, by turning failure into success, by turning experiment into solution, by taking the step, the last step, the right step, the step in the right direction, the step that produced the invention. A typical example of that is in the telephone cases, where Bell tightened a screw and changed a machine that could not convey speech into a machine that could. Just tightening a screw and thereby creating a new art. This invention has created a new art.

The process can be considered to some extent in the mechanism of its working, the manner in which it does the work. We start with an ore pulp, a mass of finely ground ore diffused in water, a muddy liquor. The ore consists of particles of worthless dirt or rock or gangue, and of valuable particles of metalliferous mineral. They have been separated by grinding, and they are diffused through this ore pulp which is kept in motion so that they will not settle. Air is introduced into this mass of ore pulp, and it is broken up into air cells or submerged air bubbles. These bubbles course through the liquid, pick out and select the valuable mineral particles and reject the gangue particles, and firmly attach to themselves the mineral particles and carry them up through the pulp and form upon the surface of the pulp a floating froth layer loaded

with metalliferous mineral. That is the essence of the operation of the process.

Why does it thus operate? With ore, water and air and such agitation as would bring the submerged air bubbles into contact with the solid particles, the air bubbles would very firmly attach to themselves the mineral particles and would reject the gangue particles and would float the mineral particles upward. But in rising through the liquid the bubbles would come together and would coalesce into larger bubbles, and when they reached the surface they would burst and explode and no froth would be formed, and no concentration of ores would be effected.

But the process in suit includes not only ore and water and air but a modifying agent, and this modifying agent in the process here in suit is oil; not every oil, because many oils are useless for this purpose; but an oil which, with the ore used, will so modify the air bubbles, and make and maintain the integrity of the little bubbles, that in fact the bubbles do not come together and they do not coalesce, but they repel each other, and as they course through the liquid they pick out and firmly attach to themselves the mineral particles and reject the gangue particles and buoy up the mineral particles and as soon as they are given an opportunity to do so they rise up through the pulp and emerge from the liquid as air bubbles having thin films holding the mineral particles, and they accumulate upon the surface into a floating froth layer which carries the mineral. This froth layer may be several

inches in thickness. We show it in this record seven inches thick. I have seen it three feet thick.

The bubbles in it are so persistent and so firmly grip the mineral particles that they may be separated from the water on which they float without dropping the mineral particles; usually by simply overflowing a dam.

The issue of infringement depends upon whether or not the appellant has carried on this process and obtained this result. Appellant admits that it did so up to January 7, 1917, in the treatment of upwards of a million and a half tons of ore. That was some two or three weeks after the decision of the Supreme Court; some intermediate experimenting was necessary.

The question is, has it continued to do so since January 7, 1917? What change has it made in its procedure which has so altered its process and the results of this process, as to change it from an infringing into a non-infringing process?

Before January 7, 1917, it used the froth-forming oil of the patent, with ore, water, air and such agitation as would develop the procedure of the patent. Since January 7, 1917, it has continued to use the same froth-forming oil, and the same procedure in every substantial respect, but has poured into the ore pulp other oils that are not, with that ore at least, mineral-froth-forming oils, and that have not prevented the carrying on of the procedure of the patent, but that have impaired it to some extent, a matter of a million dollars a year to the defendant. The froth-forming oil both before

and after January 7, 1917, was not only the same oil, but it was present both before and after as a small fraction of one per cent. of the ore.

Now, let us briefly turn to the patent for its disclosure of the invention. We find, at page 1, lines 9 to 10, a very general statement, such as patent specifications should begin with, of the general class of materials to which it may be applied:

“This invention relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like, from gangue, by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue.”

Now, that statement is broad enough to cover any ore to which the invention may be found applicable. As a matter of fact, it is applicable to those ores that have a metalliferous mineral compound, such as the sulphide of zinc and the sulphide of lead, substances like metal, or it is applicable to graphite, which is a substance like metal, having metallic lustre. But the process is not applicable to the oxide ores such as the usual oxide ore of iron; it is absolutely useless for an oxide of iron, so far as we know.

It is therefore the purpose of this broad statement not to point out just where the invention is to be applied, but to include the character of substances which may possibly develop or become useful with the application of the invention to them.

Now, oils, all of them, have a preferential affinity for metalliferous mineral; that is a common character-

istic of oil. And when we say oils, we mean that quality, it is always present; but the statement here and the statement in the first group of claims 1, 2 and 3, is intended to be broader than oils, and the moment it gets to be broader than oils, then it has to add a description of the function that oils will always perform,—that attraction for metalliferous particles which will tend to coat them.

The only significance of those words in the specifications and the claims, about preferential affinity for metalliferous matter, is in so far as they tend to include substances that are not oils. Oleic acid is the oil of the example of the patent in suit. It is the acid of fats. A soft soap can be changed into oleic acid by the addition of sulphuric acid. Oleic acid can be changed into soap by the addition of alkali. Strictly it is a fatty acid, but is always called an oil, and in this patent it is included as the specific example under the general name.

Now, the patent in suit, after having said that you might use oils and oily liquids that have a preferential affinity for metalliferous matter over gangue—those two classes of materials—proceeds to tell you how to find out what are the ores and what are the oils or oily liquids that will develop the invention. And the language of the patent specification is clear and definite. On page 1, lines 61 to 69, it is said:

“The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances, and before utilizing the facts above mentioned in the concentration of any particular

ore a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired.”

It is necessary to determine, by a simple preliminary test which oily substance will do the work.

That language of the patent was carefully considered by the Supreme Court of the United States. As a matter of convenience—I did not know what appellants were going to do—we have three copies of the original pamphlet decision of the Supreme Court which are handy for reference, and we have three copies of the opinion of the Circuit Court of Appeals in the Miami case as a separate pamphlet, and we have three copies of the opinion of Judge Bourquin in this case as a separate pamphlet, which I would like to hand the court.

In the pamphlet opinion of the Supreme Court at page 7, about the middle of the page:

“The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law.”

There the Supreme Court was considering the objection that the disclosures of the specification were insufficient because the specification told a man skilled in

the art to test and find out whether an oil would produce a mineral froth with the ore that he had under consideration.

Now, in this language of the Supreme Court it is said that such variation of the treatment must be within the scope of the claims. So we will turn to the claims, and first the group of claims, 1, 2 and 3. Those are the broadest claims in their inclusion of the modifying material; they are broad enough to include any oily liquid having a preferential affinity for metalliferous metal. In that respect they differ from all the other claims. They define such an oily liquid and then they say, and in this case in parenthesis, as though by way of example, "amounting to a fraction of one per cent. on the ore", and then they prescribe agitating the mixture until the oil-coated mineral matter forms into a froth, and then they prescribe separating the froth from the remainder by flotation.

This procedure and the scope of these claims includes only the use of an oily liquid having a preferential affinity for metalliferous matter, whether it be an oil or some other oily liquid, such as will upon agitation produce a froth of the oil-coated mineral matter. The formation of the froth of oil-coated mineral matter, which can be separated by flotation, is the very end and object of these claims. The use of an oily material which will not usefully form this froth of oil-coated metalliferous matter is a procedure extraneous to these claims. The use of an oily material which does not

form this froth of oil-coated mineral matter is a matter of indifference, so far as these claims are concerned. It makes no difference, so far as these claims are concerned whether such alien oily material is present or absent, so long as the oily material of the claims is present and so long as the alien oily material does not prevent the operation of the oily material of the claims in forming the froth of oil-coated mineral matter.

Judge MORROW. What is the alien oily substance? A substance that has no preferential affinity?

Mr. WILLIAMS. No. All oils have that; but a substance that will not produce a froth of oil-coated mineral matter is wholly alien to the claims. It won't do the thing which the claim says is to be done, which is the process covered by the claims. To give an example of that to your Honors, if you will turn to page 16 of our main brief, there is a column arrangement there showing the operations of the defendant since January 7th and before. The first column, January to December, 1916, that is the whole of the year 1916, shows the amount of pine oil—and pine oil is the oil of the claims—1.43 lbs. .07 per cent., a very small fraction.

That was the only oil used.

January 9-31, 1917, pine oil first, 1.51 lbs., practically the same .075 per cent.; but with this the alien oil, the useless oil, the inert oil, the oil that will not produce a froth with this ore, 11.93 lbs., making a total of 14.75 lbs., and a percentage of .738. There it was about half way between one-half of one per cent. and one per cent.

February 1 to 28th, pine oil 1.90 lbs. You see the pine oil increases very, very slightly, is still less than one-tenth of one per cent. The petroleum, the inert oil, increased in quantity, making a total now nearly one per cent.—20 lbs. would be one per cent.—19.33 lbs., a very large fraction of one per cent.—.967 per cent.

March 1 to 31, pine oil 2.82 lbs. That is the largest amount of pine oil; there it is a little more than a tenth of one per cent., .141; petroleum or inert oil or alien oil, 18.77 lbs., and now the total a little more than one per cent., 22.08 lbs., or 1.11 per cent.

As to April, the information supplied by the appellant was so insufficient that we could not find out the proportion of the pine oil to petroleum.

Judge MORROW. The total is stated.

Mr. WILLIAMS. Only the total is stated; it was just a trifle more, 23.91 lbs., and 1.19 per cent.

These were computed from the tables furnished by the appellant, and give the averages from the data of their operations during these periods.

Now, turning again to the patent, the second group of claims are claims 5, 6 and 7. Those claims are the claims limited to oleic acid; those claims are limited to the proportions of oleic acid which were found to produce the froth; and there the limitation in those specific oleic acid claims, is one-half of one per cent. as the maximum, and one-fiftieth of one per cent. as the minimum. That was the summing up of the experi-

ments made at the time of the invention, and, with oleic acid, one-half of one per cent. was the point at which the Cattermole granulation process had disappeared and the process of the patent in suit had commenced to appear. That is true of all of these claims 5, 6 and 7. They are oleic acid claims. They are thus limited, and claim 7 is limited to certain degrees of temperature, 30 to 40 degrees centigrade, 86 to 104 degrees Fahrenheit.

Now, we come to claims 9, 10 and 11, as to which there was a disclaimer, and claim 12, which was the broadest claim, that is the broadest oil claim, outside of the disclaimer.

Claim 12 differs from claims 9, 10 and 11 in two particulars, not one, as our adversaries say. One difference is that claim 12 specifies that the oil shall be a fraction of one per cent. on the ore, whereas claims 9, 10 and 11 say that the oil shall be a small quantity; that is one difference. But there is another difference.

Claim 12 says that you agitate the mixture to cause the oil-coated mineral to form a froth. Claims 9, 10 and 11 say that you agitate to form a froth. They do not say that the oil-coated mineral is in that froth. Your Honors will now see the significance of the statement by the Supreme Court that these claims 9, 10 and 11 were not limited to the results obtained by the process in suit.

Those are the two differences which the Supreme Court found between claims 9, 10 and 11, and claim

12, which is the one with which they should be compared. Then the Supreme Court said the patent must be confined to the results obtained; then we wrote a disclaimer in which we said these claims are to be confined to the results obtained by the use of oil in a fraction of one per cent. So we wrote into these claims the language of the decision of the Supreme Court, and whatever it means, they mean. But for the purposes of this case at bar, we do not care whether they cover a fraction of one per cent., one per cent. and a little more than one per cent., or whether they are limited to a fraction of one per cent.; for the purposes of the case at bar we are only concerned with an act of infringement which was the use of the oil of the patent, a froth-producing oil, in a proportion which is a very small fraction of one per cent. on the ore. That is the only question that is before this court as to infringement, the only issue involved in the case.

Judge Ross. We will suspend at this time.

(A recess was here taken until two o'clock p. m.)

AFTERNOON SESSION.

ARGUMENT OF HENRY D. WILLIAMS, ESQ. (Resumed).

Mr. WILLIAMS. In the decision of the Supreme Court we find at the conclusion a statement that the patent must be confined to the *results obtained* by the use of oil within proportions amounting to a fraction of one per cent. on the ore. We find throughout the decision

this insisted upon by repetition of references to the resulting froth concentrate as characterizing and identifying the invention. On page 5 we find the statement:

“The resulting froth concentrate so different from the product of other processes.”

On page 3 we find that the process in suit

“differs so essentially from all prior processes, in its character, in its simplicity of operation, and in the resulting concentrates”.

Again on page 5 at the beginning of the quotation of the substance of the testimony of Doctor Adolf Liebmann:

“The present invention differs essentially from all previous results.”

There is that repeated reference to the novel results that characterize the invention, and then the word “results” is written in as the identifying means of what is imposed as the confinement of the patent.

Now, the novelty, the great novelty of the invention is clearly pointed out in the Supreme Court opinion, that novelty consisting of two things: First, the use of an air-lift as contradistinguished from the oil-lift of prior attempts at metal flotation, this air-lift being effected by the buoyancy of air bubbles instead of by the buoyancy of oil. Second, the carrying of the metal particles by an air-froth as distinguished from an oil-float. And that novelty is summed up on page 5 of the Supreme Court opinion:

“It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the

processes of the patents relied on as anticipation, convinced as we are that the small amount of oil used makes it clear that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which had been resorted to before, and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical."

That reference to an agitation greater than and different from that which had been resorted to before is a criticism of the things that were done by the defendant in that case with prior art quantities of oil and alleged to represent prior art, all of which were done with a violence of agitation which even exceeded what was necessary in the process in suit. And the Supreme Court of the United States put its finger upon that and said that the process in suit was characterized by an agitation greater than and different from what had gone before. And that was absolutely true.

Cattermole, a metal-sinking process, had the same agitation as we have. Cattermole introduced violent agitation into the art of ore concentration. And this comparison is not with Cattermole because Cattermole is a metal-sinking process. This is a comparison with the processes wherein attempts were made to float metals and the language of the Supreme Court is clear and definite, I think, in that criticism.

Now I might refer again to that summary of Dr. Liebmann's testimony, picking out a few of the words there:

"Differs essentially from all previous results."

Again, three lines further down:

"Produces a result never obtained before."

Again, the next line:

"Froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals imbedded."

And about the middle of the paragraph:

"The froth is stable and utterly different from any froth known before."

The Supreme Court of the United States described the prior art, and we will take the language of that court. On page 2 there are references to the various patents, all of them, every one of them, except one, that are in this case. There is only one publication referred to in this case that was not in the Hyde case, and my adversary has not referred to it in his argument, and it is not referred to in appellant's briefs, so I think I do not need to give it any attention. So the prior art before this court is the prior art that was before the Supreme Court. Commencing about the middle of the page, there is an excellent summary of it:

"Prior to the date of the patent in suit a number of patents had been granted in this and other countries for processes aiming to make practical use of this property of oil * * *."

that was the preferential affinity for metalliferous particles, a common property of all oils—

“and of oil mixed with acid” * * *

acid was sometimes used and the appellant here uses acid—

“in the treatment of ores, all of which” * * *

all of this prior art—

“speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass—‘the pulp’—thus formed so as to separate the oil, when it became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue.”

It was a characteristic of the prior art that the oil carried the metal particles, that it became impregnated or loaded with the metal particles in such a condition that it could be separated with those metal particles from the gangue.

Now, just by way of contrast, we will go to a description of the process of the patent here in suit. On page 3, the middle paragraph of the page, there is a rather specific description—a description of the process as described in practice:

“The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is ‘critical’ and minute as compared with the amount used in prior processes ‘amounting to a fraction of one per cent. on the ore’, and in so impregnating with the air the mass of ore and water used, by agitation—‘by beating the air into the mass’—as to cause to rise to the surface of the mass, or pulp, a froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and

metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment.”

Now returning to the prior art, as to its classification, the Supreme Court opinion says that the prior patents may be divided into two classes.

Judge MORROW. What page is that on?

Mr. WILLIAMS. Page 2, just after what I read before; the last paragraph of the page:

“The processes, of this general character, described in the prior patents may be roughly divided into two classes. The process in the patent of the first class is called in the record the ‘Surface Flotation Process’ and it depends for its usefulness on the oil used being sufficient to collect and hold in mechanical suspension the small particles of metal and metalliferous compounds and by its buoyancy to carry them to the surface of the mixture of ore, water and oil, thus making it possible, by methods familiar to persons skilled in the art, to float off the concentrate thus obtained into any desired receptacle.”

That is the flotation part of the prior art.

In the next paragraph we have the other class:

“The process of the other class, called in the record the ‘Metal Sinking Process’, reverses the action of the Surface Flotation Processes and is illustrated by the Cattermole United States patent No. 777,273, in which oil is used to the extent of 4% to 6% to 10% of the weight of the metalliferous mineral matter, depending on the character of the ore, for the purpose of agglomerating the oil-coated concentrate into granules heavier than water, so that they will sink to the bottom of the containing vessel, permitting the gangue to be carried away by an upward flowing stream of water.”

That is the process of the prior art which was the immediate predecessor of the process in suit, and as

the Supreme Court says on page 4 of the opinion, it was while endeavoring to improve this Metal Sinking Process that the process in suit was invented—I will start in reading, at line 4 of the second paragraph:

“They entered upon an investigation of the processes of oil concentration of ores which was continued through several years and consisted of a very extensive series of experiments in which the quantities of oil, of water and acid used and the extent and the character of the agitation of the mass under treatment resorted to, were varied to an almost unparalleled extent as to each factor and the results were carefully tabulated and interpreted. It was while pursuing a comprehensive investigation of this character, having, as the evidence shows, the special purpose in mind at the time to trace the effects on the results of the process of a reduction to the vanishing point of the quantity of oil used, that the discovery embodied in the patent in suit was made. The experimenters were working on the Cattermole ‘Metal Sinking Process’ as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about five-tenths of one per cent. ‘on the ore’. It was observed, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of ‘float froth’ which collected on the surface of the mass and that the production of this froth reached its maximum when about one-tenth of one per cent. or slightly less ‘on the ore’ of oleic acid was used.”

That is an exact description of what took place at the time of the discovery, and all that evidence is before this court. Now, the Supreme Court describes that froth and describes its novel characteristics at this point:

“This froth, on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between

70% and 80% of the total mineral content of the mass treated. It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface."

That is a very full description of the invention. Those were the experiments that were being discussed in the Supreme Court of the United States when Mr. Justice McReynolds asked Mr. Kenyon when the invention appeared. And we find written right in the decision of the Supreme Court that it commenced to appear in that operation, with Broken Hill ore, and oleic acid—that it commenced to appear at one-half of one per cent. That was the subject of the discussion. It covered nothing more than that.

Now appellant refers strangely to the Cattermole specification for a definition of the oils of the process in suit. That seems a little remarkable. It is wholly unwarranted, because with Cattermole kerosene oil was continuously used in the laboratory, and heavy petroleum—petroleum residuum—was continuously used in the laboratory; and oleic acid came in at first by way of soap for emulsions, then they found advantages in oleic acid and threw aside these mineral oils and commenced to use oleic acid alone. If they had not done that they would never have discovered this invention, certainly, so far as we know; because at the time of

the discovery they tried kerosene and they tried residuum oil and they found they would not produce a froth with Broken Hill ore and therefore they wrote into the specifications, try an oil, if it produces the result, that is the oil we talk about. Of course the number of oils is infinite; they could not ever exhaust the question. We have not exhausted it today with the millions and millions of tons of material treated. They could only do what they did, put into the specification a direction "before you determine whether an oil is the oil of this process, try it; simply test it; if it works it is the oil of the process".

Judge MORROW. That is the critical proportion then?

Mr. WILLIAMS. You find also the critical proportion because it is in the evidence that when you are using this oil of the process straight, and if you have $1\frac{1}{2}$ pounds to the ton and you add another pound you spoil your process; if you have $1\frac{1}{2}$ pounds to the ton and you take away one pound you spoil the process. But when you get into another field, that these appellants have entered, the situation is different, because you can produce this mineral froth without oil, by what is known as soluble frothing agent, and it changes the situation altogether. You can produce this mineral froth with acetic acid, which is vinegar. You can produce it with alcohol, with whisky. These substances have no preferential affinity for metalliferous mineral. They go into solution in the water and stay there. And such a soluble frothing agent is present in pine oil. And when you have the soluble frothing agent, it is sometimes advantageous to that

process to use a little mineral oil. And it is a peculiar fact that when you are working that process, you may work with it the process of the patent in suit. And it is also a peculiar fact that you can add a good deal of mineral oil to the process employing the soluble frothing agent and not spoil it. But that mineral oil has nothing to do with the process of this patent which this court is now considering.

Argument of William Houston Kenyon, Esq.

And we have a patent for that soluble frothing agent process, which was involved in the Miami case along with the patent here in suit, and another still later patent, and was sustained as valid and infringed by a mixture like Pine oil, a similar mixture, by the District Court and the Court of Appeals.

Now, Mr. Bull started out by saying that the court here has merely to read, study and apply the Supreme Court decision to the facts of this case. We say the same thing. But I beg of you, take the statement of our position from us, not from the appellant's brief.

What is THE DUTY that the oil of this process, of this patent, of this Supreme Court decision, performs? On that question turns the whole issue here, the issue of infringement.

What is the fundamental inquiry that you are to make in the case of this process, this patent, this Supreme Court decision, in dealing with oil?

Are you to inquire whether it has a preferential affinity for the mineral over the gangue and by reason of that, when it is intermixed, adheres to the mineral particles and coats them,—and stop there—which is where our friends place their case of non-infringement—or must you go one step further and inquire, has it also a FROTH-MAKING CAPACITY? After coating the mineral particles, does it then on the cessation

of the agitation, FORM THE SO-COATED MINERAL PARTICLES INTO A FROTH?

This process requires not only the preferential affinity of the oil for the mineral particles to the end that it may coat them and not the gangue, but this process requires also and just as much, and, we submit, vastly more, the additional quality, the additional capacity, the additional power, upon agitation to form those coated mineral particles into froth.

Judge MORROW. Does the degree of agitation enter into the froth?

Mr. KENYON. It affects it somewhat. The Supreme Court found, for example, that there had not existed in the prior art an agitation sufficiently strong to achieve the end; that we introduced it. That was one of the things we introduced.

The process requires those two qualities of oil, and the second, even more than the first, for all oils have the first, and only some oils have the second.

The patent itself also requires it. Just let me read some lines that go right to the heart of this whole process and operation, page 1 of the patent, line 89:

“When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air-bubbles introduced into the mass by the agitation, such bubbles or air-films adhering only to the mineral particles which are coated with oleic acid” * * *

and not to the gangue. There is the vital thing, there is the soul of the operation; and if the oil will not do that, it is not the oil of this invention.

And just so with the Supreme Court decision, for in that decision it is pointed out (p. 2) that the preferential affinity of oil and the consequent coating of the mineral particles with oil, were old, citing Haynes, Everson, Kirby, and other processes of the prior art. The Supreme Court further points out that enhancing that preferential affinity by acid was old, instancing Everson; that utilizing the buoyancy of oil for lifting was old (p. 5), instancing Kirby; that utilizing the stickiness of oil—it is oil in every case that has gone to the mineral particle and coated it—utilizing the stickiness of oil was old (p. 3) in Cattermole,—the mixing of the pulp causing these sticky oil-coated mineral particles, when they hit each other, to stay together; nothing can get them apart after that, and so they build up, as a snowball builds up, into granules so large that subsequently in an up-current of water that will carry the gangue that has not been so granulated up and over a dam, they will wobble down against the current and end up at the bottom,—the Cattermole sinking process, utilizing the sticky mass of oil.

But said the Supreme Court, UTILIZING THE FROTH-FORMING CAPACITY OF OIL IS NEW WITH THESE PATENTEEES, and the court tells what it means by that; namely, to form “a multitude of air cells,” (page 6, referring to this leaflet copy) which air cells attach themselves to the coated mineral particles (page 5), and float them to the surface (page 5), and there form a froth peculiarly coherent and persistent (page 3), consisting of air-bubbles, says the Supreme Court,

modified by a trace of oil in their films—modified meaning persistent—they do not burst—and carrying also in their films a large portion of the mineral (pages 3 and 4). There is the contrast with the art; there the definition of the invention. And there the Supreme Court put it all right on this FROTH-FORMING POWER AND OPERATION.

Now, the court below held on the facts, and in exact accordance with the Supreme Court decision, that the froth-forming quality was the essential and necessary thing (Vol. I, p. clxxx and clxxxi); that the preferential affinity of oil was of less importance, instancing our 1910 patent. And the court below, assuming that all of the claims were limited to the use of a fraction of one per cent. of the oil of the patent, said that that meant the use of a fraction of one per cent. IN BENEFICIAL SERVICE; in beneficial service meaning the froth-forming operation, for that is the beneficial service of the process.

Now, when is a thing in use? When it is in course of employment achieving the end in view, its then destiny; and when, considering its capabilities and the circumstances of the case, it is performing its full duty, which should be to achieve (a) its highest potentiality, or (b) at the very least, a reasonable degree of its potentiality.

That definition of a thing "in use" applies here,—namely, only an oil that is used to form this froth in the way this patent says, in the way the Supreme Court says.

And when you have once reached that conclusion, you have determined the question of infringement in this case, on any construction of the patent, broad or narrow, whether limited to a half of one per cent. of that kind of oil or any fraction of one per cent. of that kind of oil, or what not.

Because the appellant employs, in the procedure as to which alone the question of infringement arises, only a small fraction of one per cent. of an oil having that froth-making capacity—the pine oil—a little more than one-tenth of one per cent. at the most and achieves its flotation—all the flotation that it does achieve—by the use of that pine oil in that quantity.

For two years immediately preceding this infringement it used nothing but that pine oil and achieved results better by a million dollars a year, so the experts say it is, than when that pine oil is saddled with this incubus on its back. However, after the Supreme Court decision, and, as they say, frankly, to evade the patent as they understood that decision, THEY ADD TO THEIR ONE-TENTH OF ONE PER CENT. OF AN OIL THAT WILL, NINE-TENTHS OF ONE PER CENT. OF AN OIL THAT WON'T AND CAN'T; AN OIL THAT HAS NO FROTH-MAKING CAPACITY WHEN USED WITH THE ORE OF THE DEFENDANT AND UNDER THE CONDITIONS OF THAT PROCESS.

So much for the proposition of law. Now, for the facts, because they do with this 11th hour typewritten memorandum suggest that they want your Honors to reverse Judge Bourquin on the facts,—as to what this petroleum does in their process. So I will give a little attention to this matter of fact, just to point

out that the court below finds the fact proved “practically without conflict” (Vol. I, p. clxxxiv) that some oils are effective and more are ineffective “to operate the process.” Those are his words, “to operate the process.” He holds further that the larger part of the oil used, the nine-tenths, is ineffective, wasted, and injurious. I am going to read the next paragraph on the same subject (Our Supp. Br., p. 264):

“As before stated many oils are ineffective to operate the process and that is because they have not the quality that contributes to bubble-making. What this quality consists of, wherein it lies, does not appear. With these ineffective oils agitation will not produce froth and so there is no flotation of the metallic particles.”

And the man who tries to operate the process with such oil will agitate and agitate and agitate until he dies, for the claim says, “agitate until the oil-coated mineral matter forms into a froth”, and it will never form into a froth.

“One of defendant’s witnesses testifies”—says the court below—“that in the laboratory and plant of the Utah Copper Company, one thousand oils have been tried, of which but two mixtures give satisfaction. Petroleum seemed generally ineffective by the evidence of both parties, though some of defendant’s witnesses testify to sometimes successful experiments with them. Incidentally”,

adds the Judge; he faced these men and saw some of their tests and experiments—

“Incidentally, there is suspicion that with experiments as with figures can be done anything for or against, without impropriety in the operator”.

Is that finding of fact contrary to the evidence? Are you going to reverse that finding of fact?

Now the law that is laid down in this matter of reversing on questions of fact is well stated in your recent decision on the question of title to some of these very veins of the Butte & Superior Company. This was the opinion in *Butte & Superior Copper Company v. Clark-Montana Realty Company*, filed in this court, where you said (our Main Brief, p. 44):

“There are several assignments of error to the findings of fact, * * * The appellant does not assert that the findings of fact are unsupported by competent evidence, he contends that they are contrary to the weight of the evidence. The trial court made its findings upon an evidently careful and painstaking investigation of the testimony and the exhibits, and after a personal inspection of the mining properties. We have examined the record sufficiently to see that the findings are all supported by the credible testimony of reputable witnesses. Upon settled principles which this court has always recognized, findings so made upon conflicting testimony are conclusive upon this appeal.”

Now, what is the evidence. Mr. Higgins (our Main Br. p. 41), who has been happy enough to receive the encomiums of Mr. Bull as knowing probably more than anybody else in the world about these things, took these petroleum of the defendant's process, a mixture of fuel oil and kerosene, 18 pounds—nine-tenths of one per cent. on the ore—went through all the operations with ore, water, acid and this 18 pounds of petroleum, but it would not upon agitation produce a mineral-carrying froth or effect any ore separation whatsoever. That was done right in court. He was cross-examined on it. The court below saw it. It was a thing manifest to the eye. He then put in four pounds of pine oil, two-tenths of one per cent. of pine oil—

and up came a beautiful froth; the mineral froth of this invention.

Another experiment: He took two pounds of kerosene such as the defendant uses several pounds of; two pounds of kerosene—that was the proper quantity to get the best results, if that was a froth-forming oil. He agitated it under all the proper conditions of heat, etc. and nothing came up; nothing happened; no froth was formed. He put in two pounds of pine oil, and agitated it, and up came a beautiful froth.

Mr. Janney, their own witness (our Main Br. p. 42), superintendent of the Arthur plant of the Utah Copper Company, a practical man whom they put on the stand, admits knowing many oils that will not froth, and another class that will froth and make the bubbles stable. That latter class, those that will froth and will make the bubbles stable, are the oils of this patent and this process; the first class are not the oils of this patent and this process.

Professor Bancroft (Main Br. p. 42), also a witness for the appellant, put on the witness stand as a scientist, repeatedly says that kerosene is not a frothing oil and selects it as the typical non-frothing oil, and describes the appellant's mixture here in question as consisting of the non-frothing viscous oil, fuel oil—about 15 pounds of it—kerosene, which he had described as the typical non-frothing oil—four or five pounds of that—and pine oil which is a frothing oil; that is his description of the appellant's mixture.

Mr. Engelmann (our Main Br. p. 40), another practical man that appellant put on the witness stand.

from the Ray Consolidated Company, says: "We tried at different times to run on straight fuel oil, but we could never obtain metallurgical results."

Now what does Mr. Bull present against this? We had also called Mr. Greninger, Mr. Chapman, Mr. Higgins, and Mr. Wiggin, who all testified that these petroleum oils were generally non-frothing oils. You have to try and see. If they do not froth, that is the end of it.

What does Mr. Bull reply to this?

A British patent corresponding to this in suit, in which he finds the word "petrol." Well, now, I don't know exactly what this petrol is; it may be a gasoline. Appellant is not using gasoline. It is not material whether petrol or gasoline would froth under some circumstances or would not, because these oils may froth with one ore and not with another ore. What the British patent says—in the effort of the British patentees to grasp all they can—does not prove that even the petrol they were speaking of, with the ores that they had in mind, would be a frothing oil.

Mr. Bull reads from the Cattermole patent. Because our patent refers to the Cattermole patent and our invention came to us out of the blue, while we were trying to economize oil in the Cattermole process, he says any oil described in the Cattermole patent must be read into our patent. But he overlooks this interesting circumstance. The Cattermole invention proceeds by the stickiness of oil. All of these oils are sticky. If you coat a mineral particle with enough

to take advantage of that stickiness, you can use any one of them. In the Cattermole operation kerosene will operate; these fuel oils will do; you can work the Cattermole process with any of them. But with our process—no. It is only certain oils that will work our process. And the world is indebted today to the happy circumstance that our inventors were working the Cattermole process *with oleic acid*, which has, in addition to the quality of stickiness, the then unknown quality of froth-formation, that it possesses this invention today. If they had been working with kerosene and had reduced the oil to nothing they would never have obtained this froth. Mr. Higgins says so in the original document regarding the making of this discovery. So what you find in the Cattermole patent cannot help you to interpret this patent in suit. Nothing is specified in the patent in suit but oleic acid. That will do it. What you must do is, as you are told, to try each new oil and see whether it will do the thing described as the thing to be done.

Now this was Mr. Higgins' report, page 1111, Volume 3 of the record, written within a week of the making of the invention; and in the same paper that describes the making of the invention he adds this as a note,—down near the bottom of page 1111—First, at the top of page 1110 he gives the details of an experiment with paraffine, starting with one-tenth of one per cent. and testing up to a full one per cent., and off to the right he says: "Very little float."

Now at the bottom of page 1111, where he sums it up, he says:

“A diminution of the percentage of oil when that oil is either paraffine or Balkhany crude oil, does not cause a similar frothing to the oleic acid, but a diminution in the size of the granules”—still Cattermole—“and an increase in the time required for clean up of the sands.”

Mr. Bull referred to Mr. Higgins' testimony in these typewritten pages of his. I want to add another reference to it, in connection with the further examination of Mr. Higgins, Volume 8, page 4740. Our brief does not have it; questions 49 to 53.

“Q. 49. Have you ever obtained mineral froth by the use of kerosene alone?

A. No, I have not.”

That testimony was given in May, 1917, and Mr. Higgins had been present at the birth of this invention, and has been with it step by step from 1905 to 1917, and he never had been able to obtain a mineral froth by the use of kerosene alone.

“Q. 50. By what name is kerosene known in England?

A. Paraffin oil or simply paraffin.

Q. 51. You mentioned two especial instances wherein you had obtained a mineral froth with petroleum oils. What were those exceptional instances?

A. One of them was the use of the material known as petrol which is used for motor cars in England and the other was in the use of a heavy lubricating oil such as is used for valves, and known as Cosmose^e l.

Q. 52. And is petrol in England the equivalent of gasoline in America?

A. Yes, it is the trade equivalent. It is rather lighter.

Q. 53. Did you examine these oils at the time that you made these experiments, for the purpose of determining the purity?

A. No, I did not.”

In these fuel oils that you find in the market there is mixed with them this soluble frothing agent constituent, some residuum from the way in which they are manufactured.

Mr. SHERIDAN. I must object to your bringing in evidence at this late date; there is nothing of that kind in the record.

Mr. KENYON. Mr. Sheridan is mistaken in interrupting me, because the record shows in dozens and dozens of instances of various oils of commerce containing a soluble frothing agent constituent. Almost every instance of use in the art of small quantities and certainly every instance of the use of large quantities of oil has included some crude oil, one of the constituents of which is this soluble frothing agent, and when any such thing as that is present, even in very minute quantity, it does froth.

Now, finally, on page 46 of their brief appellant's counsel refer to a 24-hour run at the Arthur Plant of the Utah Copper Company, where first there was a mixture of active and inactive oils, and they got a certain result; then the active oils alone and they got a certain result; then the inactive oils alone and they got a certain result. Strange to say the last result was better than the second, or inferior only to the first, and from that they conclude that fuel oils are frothing oils, and they say these determinations are NOT contradicted or QUESTIONED. But I want you to turn to the record, Volume 5, page 2621. Those conclusions were not only questioned, but on cross-examination THEY WERE DESTROYED, and that ended it. Let

me read to you on page 2621, beginning at XQ403. This is at the Arthur Plant. This (Vol. 9, p. 4994), is the sheet (Deft. Ex. 31) put in by this witness Janney. This is all that they talk about on page 46. At the top of the column from which they draw their conclusions are the figures "1.60."

"XQ. 403. So that as far as this sheet is concerned, showing what came in there, or 1.60 of oil, it is utterly useless?"

A. With 1.60 pounds of oil, yes.

XQ. 404. It is utterly useless?"

A. Yes.

XQ. 405. And it is utterly useless as to every one of the figures as to any of the quantities or amounts under 1.60."

It is some of these amounts that on page 46 of our adversary's brief are compared. What did he say?

"A. Yes, sir."

The only witness who knew anything about them, the witness who put them in, said they are useless.

"XQ. 406. Because in each instance the amount of oil you actually were operating with was entirely different from the figure appearing in the column in which the first figure is 1.60?"

A. Yes, sir.

XQ. 407. And when you made an experiment there was no way of demonstrating the verity of it unless you knew what was in the Dorr tank before you began? Isn't that correct?"

The Dorr tank was an enormous tank 44 feet across and 12 feet deep.

"A. I could not tell how much oil I was going to use until afterwards.

XQ. 408. Yes, and you could not tell about a great many other factors because of the remnants of the previous days' operations that had not been cleaned out? Isn't that true?

A. Yes."

Now, hasn't that been *questioned*?

Now appellant has added 9/10ths of one per cent. of petroleum oils, which does not affect the process in essence or kind. I leave that question of fact. Your Honors will not for one moment consider the proposition of reversing the court below in view of the testimony.

That added 9/10ths of one per cent. of petroleum oils does not affect the process in essence or in kind. It is mere addition. Whether it helps or hurts, it is mere addition. Reading from the argument of the appellant in the court below, concerning the fact that mere addition does not avoid infringement, counsel for appellant there said, "If you have the patented thing and use that and then add something to it, you do not avoid infringement, certainly not. That is absolutely elementary. If a man has invented the prime essentials of an automobile, and I come along and add a horn, I do not avoid the infringement, because I have added a horn to the automobile."

That is all this 9/10ths of one per cent. of petroleum is.

It is a mere addition, like the "acid" which enhances, says the patent in suit, the "preferential affinity" of the oil for the mineral, page 1, line 43 (it does not create that preferential affinity but it enhances it);

it is like the "heating", which, the patent says, assists the contacting of oil and mineral and the coating of mineral by oil, line 52; like the "fine grinding", which, says the patent, assists the formation of froth, line 56 (it does not cause the froth-formation but assists it); it is like the appellant's "sulphate of copper" that they must use, and in great quantities, and which, says Mr. Dosenbach, their expert (page 3345, Q138, volume 6), enhances grade and increases recovery and assists the acid in its action; (sulphate of copper does not create the froth but it enhances the result). Just so with the appellant's petroleums, if they enhance anything; just so whether they enhance anything or not; FOR THEY DO NOT CAUSE THE FLOTATION, THEY DO NOT FORM THE OIL-COATED MINERAL PARTICLES INTO THE FROTH.

The court below held on the evidence that the petroleums were responsible for the poorer results, and the witnesses produced on our part showed that those poorer results were not mere increased cost of oil; that they included lower grade of concentrate, diminished recoveries, increased losses in the tailings, increased cost of operation, diminished capacity of mill; all of those things costing the appellant company at the rate of \$1,000,000 a year.

The court below held, as a finding of fact, that the defendant uses the plaintiff's process for ore concentration by air-bubble flotation; that is to say, the same elements, the same combination, in the same way, with the same function, to the same results.

The court below held that the addition of the petroleum no more adds to, or changes, the process than

would the addition of any useless substance not a part of the process.

Now, is appellant's an oil-lift or an air-lift process? For every ton of ore that goes into the appellant's mixing vat, 214 pounds of metallic zinc are lifted to the top in the concentrate. The total amount of oil that is found in that concentrate useless and useful together, the whole thing would account for the lift, by the buoyancy of that oil, of about $\frac{2}{3}$ of one pound of zinc. Is that an oil-lift process, or an air-lift process?

Again is appellant's result the same as that of the process of our patent?

The witnesses on our side (our Main Brief p. 43) are all clear on that; they say the froth is identically the same thing. The witnesses on the other side are mostly silent on the subject, but Janney of the Utah Copper says there is no practical difference in the froth until you get up to about 100 pounds, that is 5 per cent., and then it begins to look oily.

Sadtler, for appellant (Vol. 7, p. 3785, RQ574) says, that with small or large quantities, if you have provided sufficient agitation, you get the oiled air-bubbles and the mineralized froth which is the new product in all cases. *Sadtler* imputed this agitation to *Everson*, *Froment* and *Kirby*; but the Supreme Court has held otherwise. However, there is no dispute but that appellant provides sufficient agitation.

Counsel for defendant in the court below has summed up the testimony in this matter of his own four expert

witnesses. This was in the oral argument in the court below (our Main Br. p. 10):

“Now I maintain that it has been satisfactorily proven by our witnesses, Professors Bancroft, Sadtler, Taggart and Beach, that there is no difference between the action of plus one per cent. of oil and minus one per cent. of oil in any respect that science can develop, and technically there is no difference. Our mill operations as set forth in these tabulated statements which we have introduced and in testimony of our witnesses show that there is no difference from a technical and commercial viewpoint. It is a case in which practice and theory are in absolute agreement.”

That testimony and that argument were made to serve the purpose of the contention of invalidity on new evidence, in the hope of getting the Supreme Court some day to reverse itself. But the fact on which it is based and the argument itself are utterly destructive of the argument of non-infringement made by counsel for appellant here, because it admits and asserts absolute identity of result.

Now an attempted answer to the charge of infringement here is its asserted unfairness or inequity in view of our argument before the Supreme Court. Appellant says that having saved our patent by saying that large oil quantities are not the equivalent of small, do not produce the same result, we now assert infringement by saying that large oil quantities do produce the same result as small and are the equivalent. The trouble with this attempted answer is that *there* the whole discussion was as to STRAIGHT OILS OF THE PATENT; 36 pounds of oleic acid, 72 pounds of cotton-seed oil, two pounds of which would do the work. That is not the sort of thing

we are discussing here. *Here* we are talking about a MIXTURE in which there is one-tenth of one per cent. on the ore of an oil that does the work, and 9/10ths of one per cent. of an oil that can't and won't do the work. The questions are not the same.

Appellant's statements as to our argument before the Supreme court are most unwarranted as matter of fact, but the Supreme Court wiped all that subject out, all that discussion of Dr. Byrnes' experiments, because as we argued, and as was the fact, they were not prior art; they were not the defendant's procedure; they were laboratory freaks, proving nothing; they failed in the mills; they were hares drawn across the path of the court to distract attention from the real questions. The Supreme Court went straight to the real prior art and said what it was, and to our real process and said what it was.

Another attempted answer is that their results are different. Having asserted in argument below that their results were the same, they assert here that their results are different, and I call it the "more oil and less mineral" argument. The Supreme Court has sustained your patent, they say, because the prior art froths have "more oil and less mineral"; our froth, they say, has "more oil and less mineral"; therefore our froth is a prior art froth. It looks rather convincing. Things equal to the same thing are equal to each other. But it is really childish. An elephant is heavier than your dog. My dog is heavier than your dog. Therefore my dog is an elephant.

No. The comparison must go deeper than that. The Supreme Court has drawn a line of DIFFERENCE OF KIND between the prior art froths and the appellees' froth, and the only question of infringement is on which side of that line does appellant's froth lie. Is it our froth, or is it the froth of the prior art? The appellant's brief does not contend that its froth is *the oil-float of the prior art*, as defined by the Supreme Court; nor is it bold enough to put its finger on *any particular process of the prior art* and say, *that is our process, that produces our froth*. Instead of that it talks of "prior art quantities of oil."

It is futile to talk of "prior art quantities of oil" apart from the character of the oil, apart from its use in the prior art process, apart from the essentials of it there, apart from its principle of action there and the results it obtained. It is futile to talk about quantity apart from those things. Of what profit or materiality is it to substitute in a frothing process a "quantity" of oil that has been found appropriate for another character of oil in a sticking process, or in an oil buoyancy process. Quantity *per se*, apart from operation or result, is nothing.

If we assume that all oils are the same and that all oil processes operate in the same way and end in the same result, then quantity and difference in quantity would be all there was to it. That was the view of this invention taken by this court and that was the view of this invention presented by this appellant in the Hyde case to the Supreme Court in urging affirmance. But that is not the real situation. That is the argument

that lies at the base of the contention that the invention and the patent are limited to a hard and fast "quantity line" regardless of ores and operations and results. But the Supreme Court has swept away that assumption. It has held that oil processes do not all operate in the same way or obtain the same result.

Another attempted answer of appellant based on alleged difference of results is this. They argue that their results are BETTER, and therefore they do not infringe; that these petroleums have some advantages, that they prevent the big particles of mineral from dropping out from the bottom of the froth, that they in some way control the froth, and they cite the use of small quantities of petroleum by our licensees to that end. But even if true that is mere addition, and does not avoid the basic invention.

Another attempted answer based on alleged difference of results is that their results are poorer. They say our results are poorer, they are \$1,000,000 a year poorer, and therefore we do not infringe. They say: "The Supreme Court gave you a patent whereby you were able to save \$1,000,000 a year. We do not save a million dollars a year, therefore we are not using your patent." This is a misconception, a ridiculous misconception, of the fact and the effect of the Supreme Court decision. That was what was argued by the appellant before that court in seeking affirmance, but the Supreme Court said, this process is not mere economy in oil, it is something else. The Supreme Court said: while you were seeking to economize oil, you found something else that you did not expect. This

was like Columbus, while he was seeking the East he came upon the West. That does not change the fact that Columbus discovered America. A new result, a new operation, both new in kind, the Supreme Court has found in this process.

Now, the court below held, as matter of law, that the law looks through the form to the substance. That cannot be error—looks to the thing that does the work—that cannot be error. If that is taken there is infringement. And the court gives an admirable and discriminating statement of what the invention is; that the AIR does the work, just as the Supreme Court said, of separating and lifting; that the air has a preferential affinity for the mineral; that the air cells capture the mineral; that air does the lifting. The court below said of this process: “It is the first of its kind.” (Vol. I, p. clxxix.) The Supreme Court has said that it struck out in a new line. Here is every element of pioneer-ship. The Circuit Court of Appeals of the Third Circuit has said the same thing, quoting the words of the Supreme Court, that this patent must be confined to the results obtained, not confined to the use of oil within a fraction of one per cent., but to the results obtained by the procedure.

Broadly construed this patent has been by the Supreme Court, as broadly as the broad results it specifies. And the Circuit Court of Appeals in the Miami case, says of that, commenting on that, that it acutely enlarges the question of infringement. Judge Bradford in the Miami case had thrown out claim 9 because it

was not limited to a fraction of one per cent. The Supreme Court threw it out because it was not limited to the results obtained when you use a fraction of one per cent., and by reason of that change from Judge Bradford's reasoning to that of the Supreme Court, the Circuit Court of Appeals of the Third Circuit said the question of infringement is acutely enlarged.

But we need no liberality of construction here. On the narrowest construction the patent is infringed; whether it is a half of one per cent.—that is a ridiculous argument, that we are limited to one-half of one per cent.—whether within any fraction of one per cent., whether it is any fraction above or below that will produce the results, the characteristic results the Supreme Court says we have been the first to attain—our patent should be construed certainly out to the full measure of the great invention,—certainly (1) to cover the use of any and every fraction of one per cent. of oil of the patent; certainly also (2) to cover every case where just that fraction of an oil of the patent is used and does the work, but is camouflaged by dummy oil not of the patent; certainly also (3) to cover the use of more than one per cent. of the oil of the patent if the excess is mere surplusage and wasted the results remaining the same, for superfluity does not vitiate; and (4) the way should be open some day, if that question of infringement should ever arise, for a court to say that the patent covers the use of more than a fraction of one per cent. of an oil of the patent even though with the particular ore in question less than that will not do the work, provided when the work is done it is done in

the same way and the result is the same; and lastly (5) it may well be, too, that claims 9, 10 and 11, as limited by disclaimer, may some day call for and require and permit a broader construction than the other claims.

But no question arises on the facts of infringement here, except the second.

We stand on our brief as to the disclaimer.

Argument of Lindley M. Garrison, Esq.

In the time that I shall devote to this case, I shall endeavor, from a standpoint which I think it would be fair to term that of a lay-lawyer, to draw from the record and from such study as I have been able to give this case since my first participation in it in the Supreme Court argument in the Hyde case, the proper conclusions as to where the issues are and where the right lies, in the deciding of those issues.

So far as the appellant's case has been developed before us up to this time by Mr. Bull, and I wish I were sure that that is all of the appellant's case that is going to be developed—I am not sure; and I shall use some portion of the time that your Honors have so graciously extended to me in an endeavor to suggest what use they are going to make of the balance of their brief, for they have utilized only a portion of their brief in their opening.

But so far as Mr. Bull has opened his case, it seems to me to be confined to these points: first, that we are restricted to a fraction of a fraction. He is not satisfied with the words of the patent. He is not satisfied with the decision of the Supreme Court. He is not satisfied that we should be restricted to a fraction of one per cent. He says we are restricted to "a fraction of a fraction of one per cent.—"that fraction which is one-half of one per cent."

Now, as a background for that argument, he argued at great length that the difference between the decision

of this court and the decision of the Supreme Court, in the Hyde case, was on a question of law. If that statement of his is not true, then whatever else may be true, Mr. Bull's argument is not true, because it has no foundation to rest on.

Now, is that true? What this court said in effect was, "in our judgment, and as we view the facts, the prior art processes produced the same result as the process of the patent in suit. The only difference that we find between the prior art processes and the process of the patent in suit is that the patent in suit uses less oil to get the same result. A mere matter of degree, not patentable."

Now, can anybody believe that the Supreme Court of the United States would disagree with this court upon that proposition of law, with the books full, with the authorities clear, with the opinion of this court luminous, upon the proper legal finding on those facts? Why, of course not.

The Supreme Court never intimated any disagreement with this court upon the question of law involved, but they did radically disagree with this court on the question of fact involved. They said in effect, "we find the resulting concentrate of this process so different from the resulting concentrate of all previous processes that there was novelty of invention and patentability of discovery." So the decision of the Supreme Court did not turn upon an economy in the use of oil. The decision of the Supreme Court does not rest upon economy in the use of oil. It rests upon the discovery

of a new function of oil never theretofore appealed to in any disclosure in the prior art. There was no process of the prior art that called for the use of oil having froth capacity. These prior art processes were dealing with petroleum; they were dealing with kerosene; they were dealing with all kinds of oils, utilizing their preferential affinity for metal, which all oils possess. That is no more a definition of oil than it would be to say "mix your pulp with water, that has the quality of wetness"—a preferential affinity for metal is just as much an inherent quality of oil as wetness is an inherent quality of water.

All these prior art processes that used oil used oil that had preferential affinity.

But what was the quality in oil that resulted in a concentrate so different from the prior art processes that the Supreme Court said that it practically was the beginning of a new art? It was the quality in oil which when mixed with ore and water produces a mineral-bearing froth. And because it is very difficult in words to describe anything, to define anything, the Supreme Court has done the very useful thing of describing and defining this invention by the results that it achieves. It could not describe it by what went into the mixture. That would not define anything. You can mix oil and water and air and agitate any way you want to for any length of time, and if you have not got a frothing oil, you won't produce mineral-bearing froth. So that if all these gentlemen had done was to do what the prior art told anybody to do, if they had not pointed out that you must select an oily liquid which will upon agita-

tion produce a froth, they would not have discovered anything, and there would not have been any patent, and there would not be an issue here for decision.

So that Mr. Bull's foundation on which all of his superstructure rests, does not exist. It is a void; there is nothing there.

Now, why did Mr. Bull in arguing that the Supreme Court had restricted us to this fraction of a fraction, spend so much time in talking about what various courts have said and what various counsel have said, and what various witnesses have said, and omit to tell you what the Supreme Court had said? Mind you, what he was doing was telling us that the Supreme Court had restricted us to this fraction of a fraction; but for some reason (perhaps I am going to develop it now), he refrained from telling us what the Supreme Court said. Now, what did it say? I am reading from page 3 of the leaflet.

“The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is ‘critical’, and minute as compared with the amount used in prior processes.”

Now, here come the words I want to call to your Honors' attention—

“‘amounting to a fraction of one per cent. on the ore’”.

Now, who is the judge quoting? What is he quoting? He is quoting the patent. Claim 1 of the patent says: “amounting to a fraction of one per cent. on the ore”. Claim 2 of the patent, ditto; claim 3 of the patent, ditto; claim 4 is out. Claims 5, 6 and 7 of the

patent, not "a fraction of one per cent.", but a fraction of a fraction of one per cent., a specific fraction 0.02-0.5; claims 9, 10 and 11 are "small quantity"; claim 12, the same thing as in 1, 2 and 3 namely "amounting to a fraction of one per cent."

Now, is it conceivable, that if the Supreme Court had in mind what Mr. Bull would have you believe that it had in mind, that our patent was to be restricted to a specified fraction of one per cent. on the ore, which is that fraction, Mr. Bull says, expressed by "one-half of one per cent. on the ore", why it didn't just quote the language in those claims of the patent, 5, 6 and 7, with respect to oleic acid? There is where the patent specifies the lesser fraction. Those claims do not say a "fraction of one per cent. on the ore". Claim 5 says "adding a small proportion of oleic acid amounting to 0.02-0.5 per cent. on the ore". Claim 6 says, "adding a small proportion of oleic acid amounting to 0.02-0.5 per cent. on the ore". Claim 7 says, "adding a small proportion of oleic acid amounting to 0.02-0.5 per cent. on the ore". So if the Supreme Court were going to restrict us to anything less than any and every fraction of one per cent. of oil on the ore, they would not have selected the claims that gave us every fraction of one per cent. and overlooked the claims that gave us the limited fraction. It is inconceivable. I do not believe that Mr. Bull himself has any confidence that that will receive more than enough consideration to dismiss it.

And so he says in effect: "I must have another argument that is plausible at least, and that is that

because this patent in stating the class of things that it indicates uses the words 'preferential affinity for metalliferous matter over gangue,' and since that is a quality possessed by all oils, it will enable me to argue that any oil is the oil of this patent, and if we use a sufficient quantity and get outside thereby of whatever this court confines the patent to, we can operate the body and soul and spirit of this patent with immunity".

I commend highly, and I am not speaking sarcastically, I am speaking honestly, the honesty of our opponents in many respects in this case. In their brief, they say with entire frankness just what they are trying to do. They say in effect "a burnt child dreads the fire, and we are trying to utilize the principle which was brought into the world by your invention, without having to recognize your invention". They say that with entire frankness. They say, of course, "if we could openly operate with the amount of oil and the kind of oil which is actually specified in the patent, it would be very much better; but if there is some way we can get the advantage of that and yet apparently be outside of the scope of the patent, that is what we are searching for". How do they search for it? Why, they say "this patent says that the invention relates to improvement in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like, from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue".

In passing let me say, any draftsman of this patent, who had used the last phrase as descriptive of oil,

would have done a ridiculous thing, because all oils have that preferential affinity. He simply was outlining a class of things from which the user of this patent was to draw, to get the benefit of the disclosures of this patent. Later in the patent he tells you to take these oily liquids, because they are all properly described as oily liquids; [oils, fatty acids or other substances having a preferential affinity], and select that one therefrom which will produce the froth; and when the draftsman came to drafting his claims, he demonstrated just what I have said.

In claims 1, 2, and 3 he is talking about an oily liquid, and there he talks about the preferential affinity for metalliferous matter. He says you must have an oily liquid that has this preferential affinity. When he comes to the oleic acid claims, he does not say anything about preferential affinity, of course, because oleic acid has it. When he comes to claims 9, 10, 11 and 12, that deal with "oil," without further qualification, he says nothing whatever about preferential affinity because all oil has it, and he knows that would not be anything that would indicate the definition of the thing at all.

So that we have in the patent itself a perfectly plain, clear guide as to what it is that is to be drawn on, how you are to draw on it, and when you come to the claims, the test of whether or not you have drawn on this class and gotten the proper material from it is whether your oil-coated mineral rises into a froth—and it would be perfectly absurd to say that anybody was operating the process of this patent

in suit unless the agitation of the mixture produced a mineral-carrying froth produced by a modifying agent. So that disposes of that feature.

Then Mr. Bull, I think at that point, thought it was necessary to fall still farther back, and in the appropriate language of the day occupy a last line of intrenchments, and that he does by saying, "Well, anyhow, our mineral oils are frothing oils". He says, "I will meet you on the facts". Well, does he? Did he point out to you any testimony which showed that during these infringing operations they were using any mineral oils, which used alone would froth? He did not. And he could not, and he cannot, because there is not one single scintilla of evidence in this case that the mineral oils that they are using will themselves carry on the process of the patent in suit; and they cannot pretend that there is such testimony, and there is no such testimony.

He finally falls back upon this, which seems to be a sort of a semi-last trench. Out of the last trench now, and back toward the resting place, and here he says, "Well, anyhow, when you have such an oil, a mineral oil, together with something which will produce froth, then you get the process of the patent in suit". Of course, that is our whole argument. In other words, when you have got the genius, the soul, the heart of this invention, when you are operating its underlying, basic, fundamental factor, it does not make any difference if you put something else in there, unless that something else has the potentiality of destroying the operation of the oil of the patent.

That was his own phrase, when you have such an oil, to wit, the mineral oil, "together with something which will produce a froth," then you are operating and getting the results of the process.

Almost his final statement was that the effect of any other construction of this patent, than that which he put upon it, would result in finding that as a result of the issuance of this patent the world could no longer go on doing what it had been in the "habit" of doing; which, of course, would be a very compelling argument that the patent could not be construed in any such fashion. In the first place, no one wants to construe it in any such fashion, and in the next place here again there is not one single foot of solid ground for him to stand on in making that assertion. The Supreme Court of the United States has directly and distinctly and often in the opinion said that the resulting concentrate of this process was entirely different from the resulting concentrate of any other process. So what does he mean when he talks about not being permitted to go on and do what they had been in the "habit" of doing, or what anybody had been in the "habit" of doing in this respect? Until this invention was given to the world no one had ever been in the "habit" of producing an air-froth. It was not known to the world. Sometimes it is difficult to determine how often you have to do a thing or how many people have to do it in order to constitute a "habit"; here we do not have anybody that did it. We were the first to do it. So how can there be any respectable, any possible argument, even, based upon

the idea that by some construction of this patent, somebody is going to be prevented from doing what he had been in the "habit" of doing in this respect?

That brings me to what I assume,—I rather hope that my assumption is incorrect—that our learned and able and astute adversary will next do. I cannot believe that Mr. Fish is going to fool around very long with these thin, inconsistent, unfounded arguments of Mr. Bull's. I think that these were red herring thrown across our path to get us chasing down the wrong road, and I am afraid we have chased a little too long on that road. Now, what do we find in their brief which Mr. Bull never adverted to and which I imagine Mr. Fish will advert to, unless Mr. Fish gets on to the fact that the answer to this is quite as conclusive as the answer to that which Mr. Bull has brought forward. It may be that he feels that there is no particular use in bringing forth two arguments, which can easily be answered, and that perhaps more can be gained by *rejuvenating* the argument that was advanced initially. But in their brief they devote a great deal of space to the demonstrations and experiments in the Hyde case, what we said about them, and what the Supreme Court held with respect to them. And from that they draw deductions, which deductions naturally are favorable to them—because they draw them. It is necessary therefore to have in mind a perfectly clear idea of what did take place in the Hyde case in this respect, and what the proper deductions to be drawn therefrom are.

We were concerned in the Hyde case with two initial questions: first, what authentically is the prior art? And second, what had we to say with respect to those things which the defendant in that case, practically the appellant here, said were prior art and which we denounced and said were not prior art?

Now, it must be remembered, always, with respect to any consideration of experiments, demonstrations, arguments or conclusions in the Hyde case, that every operation, whether it purported to be prior art or existing art or some other art, was with a single oil. And by that I mean an unmixed oil, whatever the oil was, petroleum or kerosene or fuel oil,—there was not any fuel oil in that, I believe—or cottonseed oil, or oleic acid; it was always an unmixed oil. Now, then, what did we say with respect to the prior art? We asserted in the Hyde case that no process of the prior art produced a result such as was obtained by the process in suit; and that is just what the Supreme Court has held. So that disposes of that.

We asserted with respect to the experiments said to have been conducted by their expert, Dr. Byrnes, not in our presence, and about which he testified but did not reproduce the experiments—some of those the Doctor said he had done with oleic acid and some he said he had done with cottonseed oil, and some he said he had done in percentages over one per cent., somewhere around three per cent., we will say, for the purpose of this discussion [the exact amount does not make any difference]. Now, we said with respect

to those, "we do not know what you have done in the laboratory; we have not seen it. We have heard what you said about them; we have tried these things under conditions similar to mill operations and they have failed metallurgically; they won't produce the froth of the process in suit; they won't produce the result obtained by the practice of the process in suit in mill operation." We said it then and we can say it now, if it is of any value to say it now, because there is not one scintilla of proof in this case that the oil of the patent, oleic acid, cottonseed oil or pine oil or any of the oils of the patent, if used in a greater amount than one per cent., will in the mill effectuate the process—not one single instance.

Now, how is it possible, legitimately, to claim that we are guilty of inconsistency, or that there is any limitation, or that there is any waiver, by contrasting our position here, with our position in the Hyde case? You cannot have limitation or waiver or inconsistency unless you are dealing each time with the same thing. It is absurd to say that a man or a court or anyone else is inconsistent if at the two different times that you are contrasting, he is talking about two diametrically opposed things. And that is the situation here.

In this present case, that we are arguing, every operation of this defendant is carried on with an oil of the patent plus other oils. In no operation in the Hyde case was there any mixture of oils of any kind, sort or description.

Now, I do not have to challenge my opponents with respect to that; I am not very fond of challenges.

anyhow, but they won't dare point out to me anywhere in their case anything in contradiction of that, because that is an irrefragable fact. But even if it were otherwise, what comfort can legitimately be drawn by our adversaries? That which they attempt to draw is this: they have either got to say "we are using a prior art process and getting the *same* result as the process in suit" or they have got to say "we are using a prior art process and are getting a *different* result from the result obtained by practicing the process in suit." They have got to say one or the other of those things in order to get anywhere in this argument, never mind what the facts are that they rely on with respect to the Hyde case. Let us now take up the first, namely, "that the defendant, Butte & Superior Mining Company, is using a prior art process and getting the same result as the process of the patent in suit." Well, we say to them "the Supreme Court has settled that." The Supreme Court has said that no process of the prior art produces the result of the patent in suit. So that ends that. The Supreme Court says that, and that is settled, so far as this court is concerned, whatever the Supreme Court may do if this matter is ever presented to it. So that argument must disappear.

Let us take their other argument, "that the defendant is using a prior art process and getting a different result,"—all this talk about "more oil and less recovery" and what not. But unfortunately the unanimous testimony in the case is exactly to the contrary of that. They are met by an absolutely unsur-

mountable obstacle in the facts. Their own counsel, after our witnesses, Higgins, Chapman and Greninger, and others, had gone out and looked at the operations of the mill of the defendant, and had said, "Your result is the result of the process in suit"—their own counsel said, "Our mill operations as set forth in these tabulated statements," [and these tabulated statements involve all of their mill operations] "which we have introduced, and the testimony of our witnesses shows there is no difference from a technical and commercial view point"— Well, now, if there is no difference, how on earth can the present counsel for this defendant have the face to argue that this whole case here must turn upon the fact that there is a difference. It is one of those cases, which I suppose we have all had the misfortune to be in, where one thinks of an awfully good theory but has thought of it too late. They have thought of it after the case was tried on another theory, which absolutely demolishes and destroys any possible standing ground for the theory that they would like to argue. So if they say "prior art processes, same results," we point to the Supreme Court; we say that bars your progress there because it says "that is not possible," "that is not so;" "you cannot do it;" "legally that is not possible." If they say "prior art processes and different results," here is a wall of facts that absolutely is irrefragable. So where are our learned adversaries in this matter? They are inside of a wall constructed by a grant made by the government to these inventors, construed by the authority that has the power to construe it, absolutely demon-

strating that they are within the four corners of the document.

Mr. Bull has pleasingly and charmingly wandered around, always keeping well away from the wall, so as to avoid injurious and hurtful contact, and all my learned and adroit friend, Mr. Fish, will be able to do, never mind how much he tries to persuade himself or you that he is not doing so, will be to run around in circles within the confining boundary of the terms of the patent and the language of the Supreme Court and the common-sense of the situation, and the justice of the situation. *ms.*

